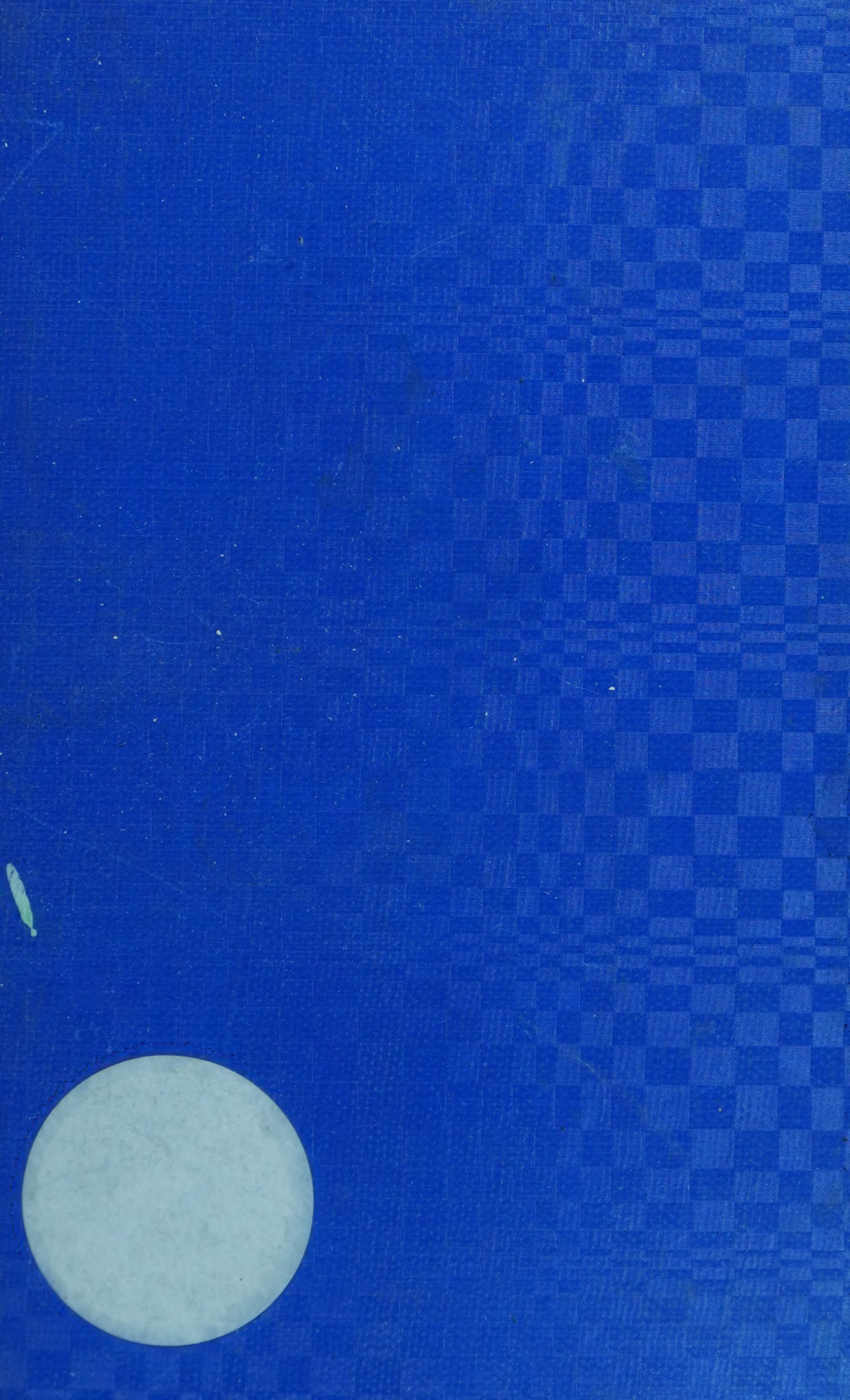


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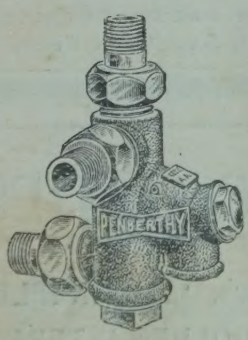
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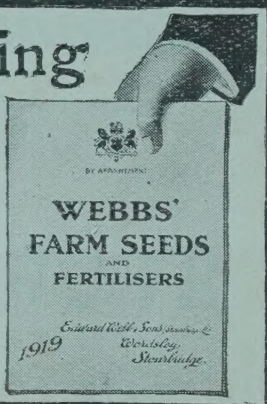
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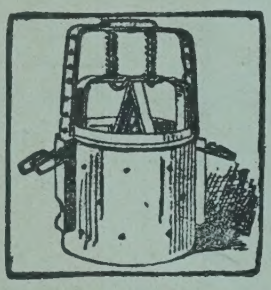
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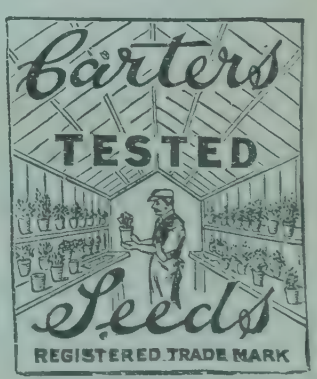
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OF ENGLAND.

THE WORK OF THE MOTOR TRACTOR.

THE war has had a profound effect upon the agriculture of this country. Within the last two years every farmer throughout the country has had brought prominently before him a demonstration of all sorts and makes of tractors and tractor implements such as could never have been organised under any peace conditions. The initial success of the German submarine campaign opened the eyes of the public to the imminent danger of the country being starved out unless more breadstuffs were grown within her own shores. The necessity of ploughing up three million acres of grass land, and cropping as large a proportion of it as possible with corn, was generally realised and the work had to be done within a few months. Farmers had already lost a large proportion of their younger labourers and they had only sufficient horse strength to deal with their existing acreage of arable land. It was therefore useless to look to horses to deal with these additional three million acres. The number of sets of steam ploughing tackle in the country could not be increased to any extent within a reasonable time, and the only other method of getting the land broken up was by means of motor tractors.

Although agricultural tractors were still, in the opinion of most farmers, only in their infancy, the Government took steps to purchase every tractor of almost any make that was available. Some were manufactured by English firms; the majority came from abroad. The initial difficulties in getting them to work were enormous. Many of the makes were practically unknown in this country; there were no trained engineers to demonstrate them or train the drivers; there were no available men accustomed to machinery to be taught to drive or treat them properly; there were no supplies of spare parts in the country nor manufacturers to make them; and there were no experienced engineers to repair the tractors when they broke down. The tractor ploughs that came over with the tractors from America had, in most cases, never been tried in England before and many were found to be unsuited to

English conditions. The whole thing was one great experiment, the cost of which was only justified at the time by the seriousness of the food situation.

Each different make of tractor had its opportunity. Many, from one cause or another, failed; some proved successful. In Kent alone fifteen different makes have been tried, including the Overtime, Titan, Mogul, Emerson, Fordson, Case, Sandusky, Burford-Cleveland, Ruston Proctor Caterpillar, Dungay-Weeks, Parrett, Saunderson and Mills, Whiting-Bull, and Sampson. Many of these had to be discarded owing to the impossibility of obtaining spare parts in sufficient quantities and the only makes now being employed by the Kent War Agricultural Committee are the Titans, Overtimes and Fordsons. The number of tractors belonging to the Committee in the county at the present time is 180, and comprises 112 Titans, 64 Fordsons, and 4 Overtimes.

Of the American tractor ploughs and other implements imported with the tractors many proved quite unsuitable for English conditions, but in other cases it was found possible to adapt them so that good work resulted. In Kent there are 242 tractor-ploughs belonging to the Committee, including 75 Ransomes, 55 Howards, 53 Olivers, 28 Cockshutts and 28 Saundersons, and 129 tractor-cultivators, chiefly Martins. The relative popularity of the various makes is by no means the same in different parts of the county; in fact the farmers in one part of the county ask for one make of plough which farmers in another part of the county refuse altogether. Different makes suit different local conditions and types of soil.

With the lack of experienced drivers or even of the material from which to train them, with the lack of experienced engineers to repair the tractors when they broke down, and of the adequate supply of spare parts, everything has been against the success of the Government tractors, but in spite of all these disadvantages they achieved their object, which was to increase the home-grown corn supply of the country, and proved their value as arable land machines. The trade in agricultural tractors is increasing daily and there is scarcely a farmer occupying 200 acres or more of arable land who has not already begun to consider whether it would not be to his advantage to become the owner of a tractor.

The experiment, born of necessity, has more than justified itself by the practical illustration it has given to all farmers of the utility of the farm tractor. Under normal conditions only large farmers would have experimented with them and it would have been many years before the rank and file farmers would have seen the usefulness of the tractor demonstrated on

their own farms. The experiment has almost revolutionised our English methods of farming, and in no other way could mechanical power have been so thoroughly tested, improved, and generally accepted in so short a space of time.

Conditions Necessary for the Successful Employment of Tractors.

It is frequently argued that for successful work to be done by tractors it is necessary for the field to be large. This is true of the larger types of tractors, but light tractors can turn almost as easily as a team of horses and there is little, if any, more waste of time at the headlands. If a large acreage of land is to be ploughed in a day the furrows must certainly be long and the turnings few, but the same applies to horse ploughing, though the effect is not so marked because the horses travel less quickly and need an occasional rest.

A light tractor drawing a 2-furrow plough can work very comfortably with an 8-yard headland and an experienced driver can work with a 5-yard headland, or with even less if a self-lift plough is used. The chief advantage of a long field is that there is less time wasted in the turns at the headlands, and less headland in comparison to the size of the field. The headland necessarily gets badly "stodged" in wet weather, especially by a heavy tractor, so that the less extent of headland there is to the field the better, though it is always more economical to allow sufficient room to enable the tractor to turn without difficulty rather than to reduce the width of the headland by a yard or two and then waste time in negotiating difficult turns.

An ideal field for tractor work is rectangular in shape, with straight hedges, and is long in comparison to its width. Short work between the hedge and the land already ploughed cannot be done economically with a tractor, not so much because of the short ploughing as of the difficulty in turning round in the gradually narrowing space at each end. This sort of work is best done with horses.

Tractors will work quite satisfactorily up or down a slope, provided they have sufficient power, but they do not as a rule do good work on a side bank, as there is always a tendency for the tractor to slide down the hill. This is counteracted by the driver steering the front wheels towards the hill, but the result is a loss of power and skidding, especially if the surface of the ground is sticky. The work of the plough also is not satisfactory, as the angle of the furrow slices, when they are being turned up the hill, is different to the angle when they are being turned down the hill. In other words, the furrow slices will be left too upright when they are being turned up the hill, or too flat when they are being turned down the hill. The trouble

could be overcome by adjusting the plough at every turn, but this would take too much time to be practicable. The only solution of the difficulty is to use a balance or one-way plough, which turns all the furrow slices either up the hill or down the hill, irrespective of the direction in which the tractor is travelling. But a tractor attached to a balance plough has to be unhitched for the purpose of turning round every time it reaches the headland, so that more time is wasted than with a run-round plough.

Another advantage of the balance plough is that the tractor can work systematically from one side of the field to the other without any setting out of the field being required. No ridges nor furrows are left requiring to be finished off. Many heavy-land fields, however, must of necessity be laid up in stetches in order that the furrows may act as open drains in carrying off surplus water, and in such cases the round-and-round plough must be used.

High-backed lands, where the stetches are very narrow, and the furrows between them deep, are a source of a good deal of trouble to the tractors. The furrows must of necessity follow the slope of the field so that the water can run away, and ploughing across the stetches is therefore out of the question. When these high-backed lands are ploughed by horses the furrow of the previous year becomes the centre of the ridge in the following year, and vice versâ, and the same procedure must be adopted when the field is tractor ploughed. The stetches are made the same width as the farmer's corn drill, or a multiple of it. The difficulty with the tractor plough, especially when three or more furrows are being drawn at a time, is to adjust the breadth of land turned over to the existing width of the stetches. A farmer owning his own tractor can overcome the difficulty by adjusting the breadth of the furrow slices and the number of furrows drawn, so that stetches of the right width are drawn, but a tractor that is on hire is required to plough fields where the width of the stetches varies from field to field, according to the ideas of the occupier of the land and the class of soil, and to make a fresh adjustment of the plough each time is a very lengthy and tedious operation. The finishing off of the lands is also a cause of trouble with tractors. A light tractor can finish them off completely under competent control, but unless the tractor is manned by a skilled driver, and there is a competent ploughman on the plough to adjust the depth of ploughing so as not to leave a deep ditch, it is preferable to complete the work with horses. It is very doubtful, in the writer's opinion, whether it is economical to use a tractor at all on high-banked land, where the stetches are less than eleven yards wide.

Types of Tractors.

Agricultural tractors can be classified into four different types—the Caterpillars, 3-wheeled tractors, tractors of the Moline type, and 4-wheeled tractors.

(*a*) *Caterpillar Tractors.*

The theory of the Caterpillar drive is no doubt sound, but in practice there are many objections to it. The rollers tend to clog up with mud when the ground is wet, causing serious friction and wear to the driving belt. When the ground is dry the soil is liable to be carried up on the belt, and to drop into the working parts of the tractor, doing serious damage. Another objection is that the bands tend to stretch, and need frequent adjustment. Sometimes they get too tight owing to mud working in between the rollers, and so shortening the belts. The steering is difficult, and experience has shown that a caterpillar tractor will skid as badly as wheels on a greasy surface.

By locking the caterpillar band on one side of the machine and revolving the other band a caterpillar tractor can be made to turn round on its own axis. This, however, is not so great an advantage as it appears at first sight, because the tractor has to draw the plough round behind it, and therefore a detour is necessary.

A caterpillar tractor has an advantage over other tractors on newly ploughed or cultivated land, because its weight is distributed over a larger area of ground, so that it does not sink so deeply into the soil as a wheeled tractor. Also it does not punish a road to the same extent. It has a great advantage over a wheeled tractor on roads full of pot-holes, on ground with a very uneven surface, or on land where there are small wet patches, where wheels would sink in.

This method of traction appeals to many farmers who are afraid of the weight of the wheeled tractors, but in the writer's opinion the compression of the soil is not such a serious matter as many farmers are led to suppose, except when the land is really wet and then no tractor of any description should be used. For threshing and other belt work a caterpillar tread is perhaps somewhat better than wheels, as it gives a steadier foundation, and takes up more vibration, but on the whole there does not appear to be sufficient advantage derived from a caterpillar tread as compared with wheels to compensate for the amount of wear and tear and the loss of power by friction in the rollers and treads.

(*b*) *Three-wheeled Tractors.*

The main advantages claimed for the 3-wheeled tractors are their lightness and cheaper construction. In one type the wheels are arranged on the tricycle plan, a pair of wheels

behind and one wheel in front. The front wheel is the steering wheel, but unless there is considerable weight on it steering is very difficult. Under certain conditions the front wheel has been known to be lifted entirely off the ground on a steep slope, and steering then becomes impossible.

The other method is to have two wheels in the furrow, one in front of the other, and a smaller wheel at the side. The objection to this system is that the tractor can only be turned one way at the headlands. There are very few 3-wheeled tractors now on the market, and they have never become very popular.

(*c*) *Tractors of the Moline Type.*

These are designed to embody the plough or the cultivator as a part of the machine, and are one-man outfits. The theory is sound, and there appears to be a good future for a well-constructed tractor on this plan. They are more easy to handle and to turn, and a skilful driver can work easily with a headland only four yards wide. They are economical of labour, employing only one man instead of two, but are difficult to adapt for haulage work.

Another type similar to the Moline, but with three wheels, carries the plough underneath the frame. The principle is excellent, except that the plough is in an awkward position for adjusting the coulters and renewing the shares. It has a vertical steering shaft almost over the third wheel and is fitted with a seat on either side of the steering wheel, which carries all the controls. For ploughing it is driven with two drive wheels in front, one being in the furrow. For hauling purposes it is driven from in front of the engine, the single wheel following. A great advantage of this type is that it could easily be fitted to plough on the principle of the balance plough by attaching another set of bottoms on the side of the axle opposite to where the present ones are attached.

(*d*) *Four-wheeled Tractors.*

These are so well known that there is no need to describe them. It has been frequently asserted that in order that the wheels of a tractor may grip the ground the tractor must have weight. This may be true on a hard and smooth road, but experience has shown that a light tractor, such as a Fordson, if it is provided with suitable grips on the wheels, can frequently work on sticky land when a heavy tractor like the Titan is unable to obtain a purchase on the soil. This may be partly accounted for by the fact that the Fordson has a 4-cylinder engine as compared with a 2-cylinder engine in the Titan, the effect of the 4-cylinders being a more even pull on the wheels. Moreover, a light tractor is able to start work again after wet weather

sooner than a heavy tractor, because it only requires the soil to be dry on the surface, whereas if a heavy tractor is not going to poach the ground it must wait until the land is dry several inches deep.

Some tractors work with two wheels in the furrow and some with all four wheels out of the furrow. The Titan and Mogul, for example, are fitted with a very short front axle, the result being that the back wheels do not run in the same tracks as the front wheels. This has the effect of distributing the weight of the tractor more evenly over the field as the tractor proceeds forward, and it does not leave such deep wheel-marks as other makes of similar weight, but it hinders, and the width of the back wheels with their extensions prevents, the running of any of the wheels in the furrow. Consequently the tractor is not directly in front of the plough, and difficult steering and a loss of power results. It may be argued that to run the wheels of a tractor in the furrow is conducive to the formation of a plough pan. On some classes of soil this argument might be sound, but practice shows that the spuds on the wheel tend to lift the soil slightly behind the wheel as it moves forward, and any danger that existed could easily be overcome by attaching a cultivator point in front of the plough to break up the soil at the bottom of the furrow to a depth of two to three inches.

Suitability of Tractors for various Farm Operations.

No general purpose agricultural tractor, suitable for all the operations on a farm, has yet been invented, nor does it appear humanly possible that such a tractor can ever exist. For road work a tractor must have large wheels and they must be well sprung, and there is reason to believe that a tractor well-sprung both in the front and back axle would not be suitable for ploughing as it would tend to rock from side to side and the wheels would skid in consequence. This difficulty might be overcome by some blocking arrangement whereby the weight would be taken off the springs when the tractor was working on the land. A tractor for road work must be heavy, to enable it to obtain a grip on a hard and smooth surface, but the weight is a disadvantage on the land, where the grip can be obtained by means of cones or spuds on the wheels.

For threshing work a tractor must be of at least 15-horse power and should have a reserve of power for preference. For driving barn machinery a much lower horse power is sufficient, and it is extravagant of fuel to use a heavy tractor for this purpose unless several machines, *e.g.* root pulper, chaff cutter, and corn mill, are being driven at the same time

Some engines are "governed" so that the fuel consumption is to a certain extent regulated according to the amount of work required of them, and in other cases designs are being prepared for governors and a pulley wheel to be fitted where necessary, but engines regulated by throttle control cannot be used economically for light work of this nature. Some makes of tractors, especially those with high speed engines, show a tendency to get over-heated when used for stationary work.

Light tractors are suitable for drawing a drill, harrow, roller, &c., and frequently two implements can be attached with advantage, one behind the other. Heavy tractors sink too much into the soil and as a rule are too slow. The pulling of a roller is attended with difficulty on hilly ground unless a special hitch is used, owing to the danger of the roller getting out of control and overtaking the tractor on a steep downward slope. As a general rule it is only advisable to attach a roller to a tractor on level land, unless the roller has a pair of shafts which are attached to the tractor by a rigid draw bar. When used for these operations the extension rims should always be attached to the tractor wheels so as to distribute the weight of the tractor over a larger area of ground and prevent the wheels from sinking too deeply into the loose ground.

Tractors are very suitable for drawing a self-binder or mowing machine, and either one or two machines can be attached behind one tractor. The Government tractors in Kent were used extensively during the corn harvest of 1918. The Fordsons and Titans drawing a Wood binder cut 9,745 acres of corn. The Titan tractors took, on an average, 1·70 working hours (exclusive of time lost in breakdowns) to cut an acre of corn, the Overtimes 1·77 working hours, and the Fordsons 1·43 working hours; in other words, the Titans averaged 5·88 acres per 10 working hours, the Overtimes 5·65 acres, and the Fordsons 7·00 acres. The actual average figures per acre for each make of tractor worked out as follows :—

	Titans	Overtimes	Fordsons
Petrol . . . . gallons	·04	·06	·04
Paraffin . . . . „	2·09	2·12	1·76
Oil . . . . „	·29	·20	·22
Grease . . . . lb.	·06	·09	·04
Working hours . . .	1·70	1·76	1·42
Repairs . . . . hours	·29	·16	·47
Delays by weather . . „	·08	·17	·06
On the road . . . „	·23	·27	·21

For every acre cut the Titans and Overtimes both lost ·60 hours on account of breakdowns, bad weather and road

travelling, and the Fordsons lost ·74 hours from the same causes. The actual time (including delays) taken by each make of tractor to cut an acre of corn was 2·30 hours in the case of the Titans, 2·36 hours in the case of the Overtimes, and 2·16 hours in the case of the Fordsons. The quantity of fuel used included the quantity used in travelling from field to field. The Fordson was more economical in fuel and cut a larger acreage per day, the cost of the work being cheaper in consequence. One Fordson tractor cut 10 acres of corn at Bishopsbourne in 10 hours on 9 gallons of paraffin and another cut $31\frac{3}{4}$ acres on 30 gallons of paraffin in $27\frac{1}{2}$ hours at Adisham. The value of a tractor for corn-cutting is particularly marked when the corn is laid so that only two or perhaps one side of the field can be cut. The tractor will travel at its top speed when the binder is out of gear, and the loss of time in running empty from one end of the field to the other is almost negligible in comparison with a binder drawn by horses.

Some French trials[1] carried out last season show that an Emerson tractor drawing a Massey-Harris self-binder could easily cut 10 acres per day (4 hectares), when cutting four sides of a field, with a paraffin consumption of not more than 1·06 gallons per acre (12 litres per hectare). A Case tractor drawing a Dering binder, cutting a strong crop of oats, cut $8\frac{3}{4}$ acres per day ($3\frac{1}{2}$ hectares) with a paraffin consumption of 1·41 gallons per acre (16 litres per hectare), and another Case tractor drawing two binders cut $17\frac{1}{2}$ acres per day (7 hectares) with a paraffin consumption of 0·88 gallons per acre (10 litres per hectare). A Titan cut $11\frac{1}{4}$ acres ($4\frac{1}{2}$ hectares) of spring corn per day with a paraffin consumption of 1·21 gallons per acre (13·8 litres per hectare).

The present-day farm tractors are very quickly shaken to pieces if used much on the roads. The nuts and bolts work loose and drop off and the frame and wheels are liable to get strained. The life of a tractor is very short if it is used much for road haulage, and it is not economical as a rule to use it for this purpose. Haulage on the land, *e.g.* drawing a self-binder or pulling a waggon to a stack in the field, is a different matter because the ground is comparatively soft and the above remarks do not apply.

The adjustments for converting horse-drawn implements to tractor use are quite simple, and a village blacksmith can make an attachment quite suitable for the purpose at a cost of a few shillings. Where the implements are fitted with movable shafts, these are taken off and a wrought-iron draw-bar is substituted. It is important that the draw-bar attachment should be fitted so that when the tractor moves forward it

[1] *Bulletin de la Société des Agriculteurs de France*, October, 1918.

neither pulls the implement unduly out of the ground nor presses it in. For vehicles with fixed shafts, *e.g.* rollers and two-wheeled carts, iron plates are usually fitted across from the end of one shaft to the end of the other, one on the upper side of the shaft and one on the lower side, these being bolted together. The draw-bar attachment is then fixed to these iron plates in the centre between the two shafts. An adjustable wheel on a short pole can also be used on drills, but with the English drill, with fore-carriage, an ordinary draw-bar will be sufficient. For self-binders, or mowing machines, the pole should be removed and a stubb pole substituted. The stubb pole is attached to the tractor with two flat iron plates bolted to the pole and a pin through the tractor draw-bar. For all cultivation implements, except a roller, a spring attachment is an advantage as it makes the implement more flexible and lessens the strain. Some manufacturers have brought out safety catches so that when the implement comes up against an obstruction the attachment releases itself and a breakage of the implement is avoided.

As a general rule horse-drawn implements require to be specially strengthened if they are going to be used for tractor work, and with such a machine as a self-binder it is necessary to be on the look out constantly for bolts and nuts working loose. It will probably be found necessary, as more experience is gained, to construct self-binders specially for tractor work.

Details of Cost.

It is very difficult to obtain reliable information as to the actual cost of tractor ploughing from private owners. Actual details of cost with reference to the Government tractors in Kent have been kept since Michaelmas, 1918, but these are not applicable to tractors in the hands of private owners. They are, however, very instructive, so reference to them here may not be out of place.

Under the Government scheme the tractors are worked in groups of eight to ten tractors each. Each group is controlled by an official, known as a supervisor, who travels from tractor to tractor in a light motor van carrying out supplies of petrol, paraffin, lubricating oil, grease and spare parts, directs the men in their work, accepts contracts from farmers, and measures up the acreage ploughed in each field as soon as the work is completed. The committee have an agreement with local engineer contractors who undertake to keep the tractors in repair, overhaul them when required and insure them, for which services they receive a fixed remuneration of 7*l.* per week for five tractors or less, 1*l.* 5*s.* per week for every additional tractor, and a bonus of 1*s.* for every acre ploughed.

The Government supply all spare parts and place a motor van at the disposal of both the engineer and the supervisor. In the costings scheme each spare part supplied has been charged for at cost price.

In the case of the private owner the expenses in connection with the supervisor are entirely eliminated and the expenses in connection with the engineer would not be quite the same. In all the calculations three acres of land cultivated have been taken as equivalent to one acre ploughed. During the eleven weeks ending December 18, 1918, 8,587 acres of land were ploughed in the county by the Government tractors. The payments to the engineers for their services amounted to 2,508*l.*, and the cost of spare parts supplied to the tractors amounted to something over 1,208*l.* Accounts to that amount have been received, but there are still a few accounts outstanding. These figures work out at 5*s.* 10*d.* per acre ploughed for the services of the engineers, and 2*s.* 10*d.* per acre ploughed for the spare parts required for the upkeep of the tractors. A further charge must be made for the depreciation of the tractor, a subject which will be dealt with more fully later.

The other items of expenditure are fuel and labour, and the cost per acre is affected by the acreage of land ploughed in a day. The Government tractors have been kept at work whenever possible and have frequently worked when a private tractor would be kept at home or even been put away for the winter. The work has been seriously interfered with by the weather, and the number of hours during which the tractors have had to stand idle on account of the weather is very serious. On these days the driver and ploughman attached to a private tractor would be employed on other farm work. In the case of the Government tractors, when the tractor was not working the men were usually out of employment, though they still received their usual weekly wage. This has increased the cost of the Government tractor ploughing very considerably. In the following table, therefore, the weekly payments made for labour have been calculated out on an hourly basis, and the hours when the tractor was standing still on account of weather, breakdowns, waiting for spare parts, or in road travelling have been eliminated. The men received a weekly wage of 33*s.* per week of 54 hours (7½*d.* per hour) up to October 31 and per week of 48 hours (8¼*d.* per hour) from October 31 onwards, with 9*d.* per hour overtime and a bonus of 1*s.* 0½*d.* for every acre ploughed. The total amount of money paid to the tractor men per week in wages, overtime and bonus, divided by the number of hours paid for, gives the cost of labour per hour, and the charge for the hours when the tractor was not working are not included.

because under normal conditions the men would be employed on other work. As regards fuel, petrol is charged for at 3*s.* 2*d.* per gallon, paraffin 1*s.* 8*d.* per gallon, cylinder oil and lubricating oil 4*s.* per gallon (3*s.* 6*d.* up to the end of November), and grease 7*d.* per lb.

	Acres	Hours per acre	Labour per acre	Fuel per acre	Total
			s. *d.*	*s.* *d.*	£ *s.* *d.*
Titan ploughing . .	4,529	4·17	9 1½	13 11	1 3 0½
„ cultivating . .	694	1·62	3 4½	5 6	0 8 10
Fordson ploughing . .	3,268	3·81	6 2	9 11	0 16 1
„ cultivating . .	862	1·39	2 4½	3 6½	0 5 11
Overtime ploughing . .	159	4·03	8 0½	14 11	1 2 11½

The above figures cover the eleven weeks from October 2 to December 20, 1918. The fuel used in driving a tractor from one piece of work to the next, often some considerable distance, is charged against the piece of work last completed. This makes the quantity used and the cost of the same somewhat higher than it would be in the case of a privately owned tractor, where the quantity of road travelling would be practically negligible. It will be noticed that the Fordson tractors are more economical of fuel than the Titans or Overtimes, and travel more quickly, but in this connection it should be noted that on the whole the Fordsons were working on lighter land than the Titans. According to the above figures, in a day of nine working hours without breakdowns, a Fordson should plough 2·36 acres, or cultivate 6·47 acres; a Titan should plough 2·16 acres, or cultivate 5·55 acres; and an Overtime should plough 2·23 acres. These figures are very low. Delays due to minor breakdowns have in many cases been included in the working hours, and the figures also suggest that the men have not worked so hard as they would be required to do if they were under the charge or in the pay of the farmer employing them.

A record has been kept of the performance of each individual tractor since May, 1918, and the following figures are based on the returns for thirty-four weeks (May to December) of seventy-eight Titans, four Overtimes, and thirty-eight Fordsons, which have been working in the service of the Committee during the whole of that period. The Titans in question ploughed 13.330 acres, the Overtimes 452 acres, and the Fordsons 7.089 acres during that period; and the table sets out the amount of fuel of various descriptions used, and the time spent per acre of land ploughed.

	Titans	Overtimes	Fordsons
Petrol . . . . gallons	·16	·28	·15
Paraffin . . . . ,,	6·80	6·72	4·27
Oil . . . . . ,,	·74	·61	·58
Grease . . . . . lb.	·18	·34	·07
Working hours . . .	4·51	4·23	3·64
Repairs . . . . . hours	2·81	6·76	2·23
Delay by weather . . ,,	2·71	3·75	1·99
On the road . . . ,,	·49	·53	·42
Delay from other causes . ,,	·61	1·49	1·19

These figures cover a different period from that quoted previously, but they confirm the statements already made that the Fordson works more quickly than the Titan or Overtime, and is more economical of fuel. The figures for the Overtimes must be taken with reserve, as they only refer to four tractors, and may not be representative.

The average acreage ploughed per tractor of all makes per week between July 12 and December 20, 1918, with details as to the paraffin consumption, hours of work done, and other information, may also be of interest.

Week ending	No. of tractors at work	Hours of actual work	Hours weather	Idle other causes	Acres ploughed	Acres cultivated	Acres mown or reaped	Equivt.[1] acreage ploughed per tractor	Paraffin consumption per acre
July 19 .	110	—	—	—	540	583	118	6·8	—
July 26 .	118	—	—	—	405	302	86	4·6	—
Aug. 2 .	127	3,561	1,879	1,449	509	334	311	5·6	6·7
Aug. 9 .	136	3,486	2,650	1,382	295	335	949	5·6	6·3
Aug. 16 .	146	7,133	124	2,343	271	580	2,988	11·2	5·4
Aug. 23 .	145	6,934	363	2,779	254	337	3,056	10·9	5·3
Aug. 30 .	147	5,500	1,524	1,517	329	751	1,895	10·0	5·7
Sept. 6 .	149	6,568	183	2,517	548	1,325	1,409	10·3	5·4
Sept. 13 .	142	3,369	3,336	1,552	541	656	159	5·8	5·9
Sept. 20 .	147	5,198	1,941	1,310	807	1,292	65	8·5	5·9
Sept. 27 .	150	4,417	2,875	1,225	868	830	35	7·7	5·4
Oct. 4 .	150	4,881	2,339	1,140	905	932	—	8·1	5·9
Oct. 11 .	153	5,896	882	1,534	1,181	825	—	9·5	5·9
Oct. 18 .	119	2,244	3,941	818	511	201	—	4·8	5·9
Oct. 25 .	140	3,335	3,221	975	786	223	—	6·1	5·5
Nov. 1 .	148	5,878	853	1,403	1,378	212	—	9·8	5·8
Nov. 8 .	121	2,161	3,615	636	538	66	—	4·6	5·7
Nov. 15 .	108	2,278	2,630	582	568	38	—	5·4	5·7
Nov. 22 .	140	4,567	429	1,700	1,098	105	—	8·1	5·8
Nov. 29 .	133	4,228	813	1,354	1,030	147	—	8·1	5·8
Dec. 6 .	58	870	1,715	360	207	30	—	3·7	5·6
Dec. 13 .	74	1,305	2,117	1,404	356	16	—	4·9	5·0
Dec. 20 .	62	1,260	1,772	313	325	—	—	5·2	5·3
Average .	129	—	—	—	—	—	—	7·4	5·7

[1] Three acres cultivated, 2½ acres reaped, or 5 acres mown have been taken as equivalent to 1 acre ploughed.

One of the greatest difficulties that the Committee had to contend with was the shortage of spare parts. These had in most cases to come from abroad, and instances have been common where tractors have had to stand idle for weeks at a time for this reason. The large number of hours that tractors stood idle "for other causes" is accounted for in this way, and the low acreage ploughed per tractor per week is also largely due to this cause. Under peace conditions this difficulty will not arise.

The following figures show the amount of work done per twenty-eight day periods by the Government tractors in Kent between July 6, 1917, and December 18, 1918 :—

Four weeks ending	Tractors at work	Equivalent acreage ploughed	Acreage per tractor per week	Rainfall (inches)
1917				
August 3 . .	20	960	12·06	4·76
September 1 . .	29	1,367	11·78	5·47
September 29 . .	35	1,692	12·09	1·17
October 27 . .	45	1,613	8·96	2·93
November 23 . .	62	2,365	9·53	1·46
December 21 . .	63	2,051	8·01	2·78
1918				
January 18 . .	43	682	3·96	3·20
February 15 . .	75	2,522	8·41	·88
March 15 . .	101	3,720	9·21	·64
April 12 . .	122	4,228	8·66	1·18
May 4 . .	115	2,713	5·90	3·41
June 7 . .	127	4,556	8·97	·59
July 5 . .	117	3,254	6·95	·80
August 2 . .	117	2,655	5·67	3·88
August 30 . .	143	5,324	9·28	·89
September 25 . .	147	4,771	8·13	4·62
October 23 . .	140	4,114	7·32	4·21
November 20 . .	129	3,722	7·20	1·74
December 18 . .	82	1,982	6·06	1·84
Totals . .	90	54,299	7·93	46·45

The records of the individual tractors that have done the most work during the above period are as follows :—

(*a*) TITANS.

Tractor Number	Acres ploughed	Acres cultivated	Acres reaped	Equivt. acreage	Gallons of paraffin consum'd	Paraffin per acre	Hours work	Hours idle for repairs	Hours idle for weather	Hours travelling
5,555	120	328	144	280	1,543	5·5	1,157	145	380	43
5,531	125	395	125	296	1,527	5·2	1,170	60	503	57
5,546	236	192	—	300	1,920	6·4	1,069	313	443	106
3,023	139	296	61	261	1,506	5·8	866	268	547	146
403	224	175	23	268	1,512	5·7	1,106	500	301	65
3,804	100	237	136	234	1,047	4·5	951	50	186	81
2,519	134	—	104	176	916	5·2	695	171	330	45

(*b*) FORDSONS.

Tractor Number	Acres ploughed	Acres cultivated	Acres reaped	Equivt. acreage	Gallons of paraffin consum'd	Paraffin per acre	Hours work	Hours idle for repairs	Hours idle for weather	Hours travelling
1,204	131	256	218	305	1,031	3·3	1,034	66	428	61
859	180	131	137	286	1,427	4·9	1,304	206	456	182
1,197	215	223	71	307	1,304	4·2	1,198	217	259	63
1,201	97	314	171	270	958	3·5	953	73	325	78
1,211	148	216	171	287	1,398	4·9	980	159	350	146
1,193	224	21	98	268	929	3·5	869	187	432	82
1,207[1]	80	110	238	212	735	3·4	686	347	261	88
1,198[1]	127	—	165	191	830	4·3	592	130	465	49
(*c*) OVERTIMES.										
146	105	115	97	183	1,330	7·3	698	258	580	101
5,850	94	109	117	178	1,083	6·1	774	198	614	78

[1] Twenty-three weeks only, July to December, 1918.

In January, 1917, the writer collected information from forty-five private tractor owners in Kent as to the acreage ploughed per day, and the fuel consumed, and the results may be summarised as follows :—

Make of tractor	Number of tractors	Acreage ploughed in 8 working hours	Depth ploughed	Number of furrows	Fuel per acre ploughed	Fuel per hour of threshing
		Acres	Inches		Gallons	Gallons
24 H.P. Overtime .	21	4½	6 to 7	3 to 4	3	1⅓
22½ H.P. Dungay Weeks	13	2½	6 to 8	2	3½	—
16 H.P. Mogul .	8	3¾	5 to 7	3 to 4	3½	1½
18 H.P. Saunderson & Mills	2	2½	6	2	4	—
24 H.P. Standard .	1	3½	8	3	2½	—

These figures show that a tractor in private hands should plough 2½ to 4½ acres of land per eight working hours, according to the make of the tractor, with a fuel consumption of three to four gallons per acre. These tractors have, of course, only been worked when conditions are favourable, whereas the Government tractors have been at work under all conditions whenever work was in any way possible, and as a rule have been set by farmers to plough the worst fields on their farms. In nearly every county, however, a Government Fordson tractor, with a self-lift plough, has ploughed over five acres in the day, under favourable conditions, in the hands of one competent man or woman.

whilst the same tractors have frequently cut fifteen acres of corn in the day with a self-binder.

Depreciation and Wear and Tear.

The depreciation and wear and tear of a tractor depends on the extent to which it is used, the kind of work it is set to do, and the attention it receives. A tractor that is only employed under favourable conditions, and is put away under cover for the winter when the wet weather sets in, will last much longer than a tractor that is kept at work under all conditions. A tractor that is used much for road work will wear itself out very quickly as compared with a tractor that is only employed on the land. An efficient and careful driver who takes an interest in his tractor is all-important in this connection. It is most essential that the tractor should be efficiently lubricated. Grease caps are fitted by most manufacturers, and if the driver will only see that these greasers are properly filled and screwed down once or twice every day, it will increase the life of the tractor considerably. Over-greasing is a good fault, and one easily remedied. The only trouble caused by over-lubrication of the engine is a dirty plug, and a more frequent need to clean the cylinders and valves. Under a careful and skilful driver a tractor will last for many years, whereas the same tractor in other hands might be worn out in two or three seasons.

The wear and tear of a high-speed engine must mean a shorter life to the wearing parts, greater consumption of lubricants, and need for more efficient and careful attention than with a low-speed engine. It is most important that a driver or an owner of a tractor should understand thoroughly the construction of the same. Many owners and drivers unfortunately do not understand the working of their machines; they only know that if they move a lever the engine will go faster or slower, as the case may be. It is money well spent on the part of the owner to see that the man who is to drive his tractor receives at least a week's training before he is left alone with the machine. For preference the man should go into a workshop for a week or ten days, and see a tractor taken apart and re-erected. Failing that, the owner should pay for a skilled mechanic from the manufacturer's works to instruct the future driver by working with him on the farm until he is proficient. The most common mistake made by farmers is that they expect one of their labourers to handle their tractor and look after it without proper tuition. Yet the same farmer would look aghast if any one suggested that he should allow the same man to drive and take care of his car. They look on a tractor as similar to any other farm machine, whereas a

tractor needs fully as much knowledge and care (if not more) than is required to drive and do the running repairs of a car.

During the first season a tractor should cost very little for repairs, and under average conditions the depreciation may be put at 30 to 35 per cent. of its original cost. In the second year the bill for repairs will be appreciable, and it will increase gradually every year until the time comes when it will pay the owner better to purchase a new tractor rather than renovate the old one. Depreciation, exclusive of repairs, may be placed at 20 per cent. for every year after the first season.

Another basis on which depreciation can be estimated is the life of the tractor. Taking the life of the tractor as 1,000 acres ploughed and the difference in the market value of the tractor between the time when it was new and the time when it had completed that acreage as 200*l.*, the depreciation, exclusive of repairs, works out at 4*s.* per acre ploughed. Interest on capital invested may be held responsible for another 1*s.* per acre.

The Advantages to be Expected from the Use of Tractors on the Farm.

Tractors are costly machines, and it will not, as a general rule, pay a farmer to purchase one unless he has a sufficient acreage of land to keep it at work during a certain number of days in the year. It is true that when there is no work for the tractor it can be put away at little expense, whereas a horse with no work to do still requires feeding. This is an enormous advantage in favour of the tractor, but it must not be thought that a tractor put away costs nothing. The money invested in the tractor is lying idle, whereas it might be drawing 5 per cent. interest if otherwise invested. The cost of different makes of tractors varies enormously, but 5 per cent. on only 300*l.* is 15*l.* per annum, *i.e.*, 5*s.* 9*d.* per week, to which must be added depreciation. No matter how carefully a tractor is put away for the winter, its market value is bound to decrease, and nothing will altogether stop the rusting of iron. Moreover, a tractor cannot do all the work on a farm, and a certain number of horses will always be required.

It would be unwise to define any particular acreage of land as being required to justify the purchase of a tractor, because there is another and very important factor that enters into the calculation. On stiff soil especially it is all important that the land should be ploughed and cropped at a particular time, and if the purchase of a tractor enables this result to be achieved, the value to the farmer of the work done is far in excess of

what the work actually cost. The value can only be assessed by comparing the value of the resulting crop with the value of the crop that would have been obtained if the cultivation work had been done at the time when the horses could have done it. This is the great value of the tractor. When the ploughing and the cultivation is finished the tractor can be used for drawing the harrows, the drill, and the roller. This is somewhat light work for a tractor, but the work must be done when the land is ready, and when the weather is right. The tractor may do the work, and can do it quickly, and does not tire. It can work from daybreak to dark, drawing one, two, three, or four furrows, according to its power. On moonlight nights, with a change of drivers, it can work the whole of the twenty-four hours. Attempts were made in Kent during the spring of 1917 to keep the tractors at work all night by using strong headlights, but the result was unsatisfactory. The shadows cast by the headlights were very deceptive, and the quality of the ploughing work was poor. With a fair sized moon, however, night ploughing is quite feasible, and a 3-furrow plough, breaking up half an acre per hour, will turn over a large area of ground in the course of two or three weeks of fine weather. From that point of view a tractor is of more value to the heavy land farmer than to the light land farmer. The number of days in the year on which heavy land can be dealt with is strictly limited, and it is all-important that as much work as possible should be done during those few days. If horses are relied on a large number must be kept, and during the wet winter months they will be eating their heads off in the stable, but a tractor will do the work of four or five teams of horses, and can be put away with comparatively little expense until it is required again.

On lighter land the advantage of tractors over horses is not so marked, as the horses may be worked a larger number of days in the year, and the need of pressing on the work during certain seasons is not so great. In such cases it becomes more a question of a comparison between the cost of working a tractor and the cost of keeping an equivalent number of horses. In the writer's opinion, under ordinary circumstances, it will not pay an occupier of less than 200 acres of arable land of average texture to own a tractor, but an occupier of a heavy land farm would be justified in owning a tractor on a smaller acreage. A proportion of these 200 acres would be under seeds, perhaps forty or fifty acres, and a light tractor ploughing two and a half acres per day would plough the whole of the remaining 150 acres in sixty days. There would be a certain amount of cross ploughing to do, and the tractor would also occupy a portion of its time in cultivating, harrowing, and possibly

rolling, drilling, drawing carts, and driving barn machinery, but the greater part of its time it would be idle. In the case of heavy land a crop sown in September or October can generally be depended upon to yield well at harvest time, whereas a November or December sowing spells failure. So important is the time of getting the crop in that on such a soil it might even pay a progressive farmer with only 100 acres of arable land in his occupation to purchase a tractor.

Theoretically, a tractor, if it is to be put to its fullest possible use, should never be idle, and it would be interesting to know exactly how much work a farmer's tractor kept continuously employed would get through in a year. The records of the Government tractors, even if available, would be somewhat misleading in this respect, because the tractors frequently have long distances to travel from farm to farm, and are driven by men who cannot receive the same amount of supervision as would be given by a farmer to one of his employees. On the other hand, the Government tractors are always canvassing for work, even in mid-winter, when a prudent farmer would probably have put his own tractor away until the drier weather sets in. Unfortunately, records of the individual Government tractors employed in Kent are only available for the thirty-four weeks from April 20 to December 18, 1918, but during that period three tractors did work equivalent to the ploughing of 300 acres each. It must further be remembered that it was War time, and that when once a tractor broke down it frequently had to stand idle for weeks before spare parts could be supplied, also that the tractors were frequently set to plough fields which a farmer would never employ his own tractor, if he had one, to plough.

The greatest enemy to the tractor is the weather. It is essentially a fine weather machine, and in ordinary conditions a farmer is well advised to get forward with his work in the autumn and then put the tractor away until February or March when the land will have again become workable. Very careful account was kept of the time lost on account of wet weather by the Government tractors in Kent between July and December, 1918 (see p. 14). It was found that no less than 42,104 hours were lost through this cause, an average weekly loss of 2,005 hours. This figure only refers to tractors at work in the field, added to which there were 356 tractor-weeks entirely lost through tractors not working at all. Taking these as 119 tractor-weeks of 54 hours each and 247 tractor-weeks of 48 hours each (the hours of work laid down by the Wages Board) there is an additional figure of 18,282 hours of time lost, bringing the total time lost through the weather up to 6,388 hours. On a basis of the amount of work actually

done in the available working time this means the loss of some 14,158 acres of ploughing work.

A light tractor like the Fordson will plough on an average 15 acres of land per week, and with a self-lift plough can be controlled by one man or girl. A pair of horses and a man will average about $4\frac{1}{2}$ acres per week but will not plough as deeply. The tractor with one man will, therefore, do about three and a half times as much work as one man and a pair of horses, *i.e.* it will do the work of three and a half men and seven horses. The cost of fuel will be about 9*s.* per acre and labour 3*s.* per acre. On the other hand, the cost of keeping seven horses for a week may be estimated at 10*l.*, and the cost of three and a half horse-men at 39*s.* per week each (the minimum wage for horse-men in Kent) will be 6*l.* 16*s.* 6*d.* It will be noted that in the case of tractor ploughing the cost of labour is therefore roughly 3*s.* per acre ploughed and in the case of horse ploughing roughly 9*s.* per acre ploughed. A rise of 10 per cent. in the price of labour would increase the cost of tractor ploughing by about $3\frac{1}{2}d.$ per acre and the cost of horse ploughing by 11*d.* per acre. In other words, a rise in the price of labour would affect the cost of horse ploughing more than the cost of tractor ploughing, and the more wages rise in value the greater is the advantage to be derived from using a tractor. As an illustration of the value of women as drivers of light tractors the case of a lady working a Fordson tractor and Oliver plough in Romney Marsh may be cited. On the stiff land of Romney Marsh she ploughed 133 acres of land during the eight weeks ending November 27, 1918, in spite of much wet weather, an average of 16·62 acres per week, with a paraffin consumption of 2·87 gallons per acre. At the present time there are twenty-four women tractor drivers working under the Kent War Agricultural Committee.

In favour of horses it must be admitted that there are many days in the winter when the horse ploughs can work but a tractor must stand still; but to such an assertion a tractor owner will reply that by the help of his tractor he has been able to get all his ploughing done in the autumn, and that by the time the short wet winter days of December and January set in the whole of his ploughing is completed. One of the commonest mistakes made by private tractor owners is trying to use their tractors when weather conditions are unfavourable. A tractor is essentially an implement of opportunity; with the advent of tractors winter ploughing on the present scale will become a thing of the past, though there will be sufficient to be done after the root crops have been drawn off to keep the small number of horses still employed on the farm occupied.

Comparative Advantages and Disadvantages of Tractor Work and Steam Tackle Work.

On a large farm there is scope for horses, tractors, and steam tackle as well. Steam tackle will, as a rule, move the soil to a greater depth than the majority of the makes of tractors and tractor ploughs, and is more suitable for cross ploughing or cross cultivating land where tractors would sink deeply into the loose soil and exert a large proportion of their energy in dragging themselves across the field.

In theory there is little doubt that the power developed by tractors could be more economically used if they were worked in pairs and used to draw a plough backwards and forwards across the field on the same principle as the double engine steam tackle. The work required of a tractor in drawing its own weight over the field, especially if the soil is loose, is very great, and often absorbs the greater part of the energy generated by the engine. If the tractor was stationary at the end of the field, was fitted with a winding drum, and utilised the whole of its power in drawing the plough or cultivator across the field, it could pull a wider implement and deal with a larger acreage with the same consumption of fuel. There would be some waste of power in pulling the weight of the rope and the friction on the same, but this should be more than counterbalanced by savings in other directions. Unfortunately, there are practical difficulties in the way. In the first place, a large winding drum is necessary on which to wind up the necessary length of rope that would be required to stretch across the field, and the wheels of the present-day tractor are not sufficiently widely spaced to admit of a large drum being fitted. In the second place, the tractors are not heavy enough to take the pulling strain, and would overbalance unless they were anchored, and practical difficulties arise in the anchoring, as the anchors would have to be moved every time the tractor moved forward. Many mechanics have tried to solve these difficulties, but so far without success. A large winding drum might be fitted to the stern of the tractor, but then the tractor would have to be employed endways to its work, and could not move forward as required. Or the necessity of a large winding drum could be avoided by having an endless rope between the two tractors. In that case, however, the distance between the two tractors must always be the same, and unfortunately the width of every field varies. If the practical difficulties could be overcome the writer is of opinion that the proper method of employing tractors would be as miniature steam ploughing engines. Work could then be done on many days when at present the surface of the land is so sticky as to make it impossible.

Tractors have one great advantage over steam plough engines in that they do not require feeding with large quantities of coal or water. A pair of ploughing engines require the full time services of a horse and cart in carrying coal and water. A tractor, if provided with a lock-up trailer, can carry its own requirements of petrol, paraffin, oil, grease, and water.

The tractor has other advantages over the steam plough tackle in that it can be used for other purposes on the farm besides ploughing. It is a farmer's machine, whereas the steam plough tackle is the property of the specialist. The steam plough tackle will plough and cultivate a man's fields, and must then move on to another farm. The tractor, on the other hand, can plough, cultivate, draw a harrow and drill, and then go home and drive the barn machinery.

The Defects of the Tractor.

The first requirement of the ordinary farmer is the general purpose tractor. Reasons have been given to show why, in the writer's opinion, such a tractor can never be constructed, but some manufacturers have other views, and if a tractor can be constructed suitable for road haulage and stationary work, as well as for ploughing, cultivating, and other field work, a new epoch in the history of agricultural machinery will be reached.

The most essential work for a tractor is ploughing and cultivating, and this should be the first consideration of the farmer when he thinks of purchasing one. Threshing and the driving of barn machinery is a secondary consideration. The ideal tractor should be so constructed that it will plough, cultivate, draw a drill, roll or harrow, pull one or two self-binders or mowing machines, drive a threshing machine, circular saw, or barn machinery, and drag one or more waggons about the field. For this purpose the tractor must be of medium weight, so that it will not unduly pan the ground, and of 18 to 25 horse power. It must be economical in fuel consumption, and simple in construction, so that any person of average intelligence can drive it. The fewer levers and controls on the tractor the better. The ideal control is one only for the magneto, and the other for the carburettor.

There is much room for improvement in wheel attachments for preventing skidding. These must be effective, and must also be easily and quickly removable, so that the tractors can travel from field to field without cutting up the roads. With wide rims, and a liberal supply of cones or paddles according to the soil, the gripping power of the wheels can be considerably increased, whilst for front side slip, which occurs in many tractors, the fitting of segmental angle pieces of quite three inch section, the larger the better, around the front wheels, is

very efficacious. Most tractors are comparatively light on the front wheels, and this encourages side slips. It has sometimes been found in practice that small cones fitted to the front wheels in place of the angle strips has prevented the wheels from skidding, and in addition has given a better purchase for the driver. The great point in favour of the "Moline" type of tractor is that the weight is well to the front, and the steering still quite easy.

Very few tractors are at present adapted for driving barn machinery. Throttle driven engines are not suitable for this purpose, and some form of governing as well as a driving pulley is essential.

A tractor which did not have to turn round at the headland would be a great advantage. Such a tractor would require a balance plough, and when it reached the end of the field it would merely reverse and return again without ever leaving the furrow. There would then be no stodging of the headland or waste of time. The difficulty in steering, and the necessity of increasing the weight, and complicating the construction of the tractor, are serious practical objections.

In the writer's opinon many of the present day tractors are too heavy and too clumsy. Practical experience has proved that a light tractor will stand up to its work where a heavy tractor has to stand still, and, given sufficient power, the light weight tractor has many advantages over the heavy one, especially as regards price. The price charged for agricultural tractors is one of the first considerations of the average farmer, and the extra cost of the heavy weight tractors is not commensurate with the advantages derived from their use. A light tractor can be easily started and driven by women. A certain amount of weight will, however, always be necessary to enable the tractor to stand the enormous amount of vibration it is subjected to. The vibration could be reduced by multiplying the number of cylinders to six, or even more, but this would complicate the construction, and also increase the fuel consumption and cost.

The present type of light tractor generally in use has not quite sufficient power on really stiff land. It has to run all out with opened throttle, and there is no power in reserve. Constant work at full capacity is not allowing the engine a chance to do its best. The farmer wants a light tractor, with spare power in reserve and with an engine running at a normal speed. The Fordson has a high-speed engine and it has not yet been on the market for a sufficient length of time to show how long the engine can stand the strain.

The ploughs attached to the tractors are quite as much in need of improvement as the tractors themselves. The speed

at which the tractor travels affects the quality of the work done by a particular plough, and an adjustment which is suitable at one speed may be quite unsuitable at another. This is a matter which requires urgent attention at the hands of the manufacturers. Tractor cultivators are also capable of improvement and there is not yet on the market a satisfactory tractor harrow.

In conclusion, the writer wishes to express his thanks to the following gentlemen for their kind advice and assistance in the preparation of this article :—Messrs. W. Back (Wye), G. R. Barrett (Canterbury), W. Bulbeck (Sevenoaks), N. A. Hornby (Wrotham), W. H. Judge (Tenterden), T. W. Pullen (Sittingbourne), C. Taylor (Wye), L. F. W. Tetley (Canterbury), W. Martin Walter (Shorncliffe), and C. H. Wickham (Yalding).

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THE BREAKING UP OF PERMANENT GRASS IN 1918.

One of the outstanding features of the agriculture of this country before the war was, generally speaking, the large proportion of the cultivated land that was permanently under grass. Farming was largely a matter of pasture, and it had become in many places almost a canon of English husbandry—accepted by the owner and occupier alike—that a field having once become a pasture must not again be defiled by the plough. Nor was it perversity that accounted for this view. The causes which led to the decline of arable farming in England need not be discussed. While it is perhaps true that in particular cases the exclusion of the plough was not due to any good reason, it may in the main be said that there were causes sufficiently evident to justify the farmer in the conviction that his own prosperity was bound up with his grass land, and the country very generally accepted his view.

It is not therefore surprising that when it became necessary to increase the area under arable cultivation in this country, there were many who regarded the new policy with some misgiving and showed some reluctance to depart from a system of management to which the experience of the past generation had suggested no safe alternative. But the stress of national necessity created a new situation which could only be met by reverting to an earlier system of farming, and increasing materially the arable area of the country. While none questioned the necessity for the production of food at home

on a largely increased scale, there was undoubtedly considerable difference of opinion as to the method by which this could best be done. It was clear, however, that without in the least minimising the effects on production of improving the methods of dealing with existing arable land, the case could not be met except by adding materially to the arable area by ploughing up grass land. This has now been done to the extent of over one million acres in England and Wales, the bulk being in 1918. The year 1918 has been a notable one in many ways, and not least so in the change which it witnessed in the agriculture of this country. Pressure was, of course, a factor in the case, but in any event the change has been a remarkable one and its results have, in general, been gratifying. The agriculturists of this country have accomplished many things, but perhaps nothing finer than they did in the last year of the war.

The object of this article is to deal not with the policy that led to the breaking up of so much grass land but with the land itself, and more particularly with the conditions in regard to ploughing and cultivation which made for success or failure with the crops sown upon it.

The Conversion of Grass into Arable Land.

The process of converting permanent pasture into arable land is new to the experience of many agriculturists of the present generation, and it presents many problems the solution of which calls for somewhat special knowledge and skill on the part of the farmer. The results which have been obtained in the last two seasons on land newly broken up from grass have shown that when the land has been treated in a particular way excellent crops have followed, while very disappointing crops have been yielded by the same type of land treated differently. It is equally clear that the results have varied largely with the character of the soil and that in order to ensure success the methods of cultivation must be adapted to the land. It will be nothing new to farmers to be informed that a procedure which has been eminently successful on light land has proved less so, or even a failure, on clay, and that a method which has secured admirable results in the north has proved unsuitable in the south. The suitability or otherwise of a method of preparing the land for a crop is not merely a matter of soil, but is to no small extent determined also by conditions of climate and by the character of the particular season.

Pastures vary much in quality and in their capacity for production in the way of meat and milk. In general, it is certain that land under arable cultivation is capable of a

greater total production of food than land under grass. Nevertheless some pastures are more likely than others to produce satisfactory results when ploughed. The suitability of a particular pasture field for arable cultivation must be determined by such a consideration as whether the land is of such a character generally as to make it reasonably probable that it will, with proper cultivation, yield remunerative crops. While it may be shown, and experience may prove, that production can be vastly increased by the conversion of grass land into arable, it does not follow that this applies to every pasture field in the country. In any permanent system of management of land there must be such a relation between the value of the produce obtained and the cost of its production that the farmer can secure a satisfactory financial return. It is probable that on certain classes of land arable cultivation may not be expected to secure the most profitable production either from the point of view of the nation or that of the farmer. Wet, undrained land, very heavy adhesive clays, excessively dry sandy soils and land at high elevations are not in general likely to prove profitable under tillage. It is, of course, true that in many cases some of these soils are capable of improvement and of being rendered fit by drainage and other means for arable cultivation. But when all allowance has been made for the land that for one reason or another is not suitable, at least in its present state, for breaking up, it is probable that there is still a large area of grass land in this country that could with great advantage, both to the nation and to the farmer, be converted into arable land. Good grass land contains stores of fertility which when once opened up by proper cultivation become available for successive crops, while many of the poor pastures which carry an inferior sward may be so improved by ploughing as to have their yield at least doubled in many instances. It must, however, be emphasised that in view of the variable character of the land under grass in this country, and the difference in the climatic conditions between one district and another, the selection of pasture land for conversion into arable calls for the exercise of judgment. A certain want of discernment in this direction may perhaps account for some of the failures which were experienced during the past season. But when all the circumstances are taken into account the feature of the ploughing programme of last year was its successes rather than its failures.

Time and Method of Ploughing.

Clays and Heavy Loams.

Of the total area of grass broken up in the past two seasons, much of it was on heavy land, including clay and the heavier

types of loam. A large area of land of this description in different parts of the country went out of arable cultivation fairly early in the period of depression. Moreover, much of it became grass by the simple process of being left alone, with no effort on the part of the farmer to form a pasture out of it by sowing a proper mixture of seeds, or by any other systematic method of treatment. In consequence, a large proportion of the grass land on these types of soil that has now been ploughed up was in certain districts, notably in the Midlands and south of England, of very inferior character, and a very considerable area was derelict.

In dealing with these poor pastures on heavy land, the time of breaking up is a factor of much importance. The evidence obtained last season appears to show that in the drier districts of the south and south-east of England the crops in general were better where the land had been broken up early and allowed to remain open to the effects of the weather for some months before the crop was sown. If intended for wheat, it may be said that in general old pastures on the heavier classes of soil and in the drier districts cannot be relied upon to yield a satisfactory crop unless they have had a summer fallow. For the purpose of breaking up land of this description steam tackle has great and obvious advantages, especially where extensive areas have to be dealt with. An effort should be made to break up the land in May and certainly not later than the beginning of June so that it may have the full benefit of the summer sun. Indeed, experience in some parts of the Midlands shows that it is frequently impossible to secure proper tilth by autumn unless the land is broken up as early as April. The turf in the case of inferior grass land is largely composed of weeds and it is essential for proper cultivation and cleaning that the turf should be killed on the surface and not buried in the soil.

In breaking up any old and poor pasture on heavy soil in early summer, it is better not to plough deeply in the first instance. A shallow and somewhat flat furrow is in itself more effective in killing the turf, and it also makes it easier for subsequent cross-ploughing. If the land should for any reason not be broken up until after the hay harvest, it is then all the more necessary that a deep furrow should be avoided. The object is to kill the turf effectively. There is no agent for this purpose equal to the summer sun, but the thoroughness with which the killing is effected depends in a great measure upon the thickness of the furrow slice.

The following cases taken either from the returns collected by the Food Production Department or from notes made at the time of inspection may be regarded as typical of the class

of land under discussion, and as illustrating very clearly the advantage, in general, of early breaking up in the drier parts of the country :—

Crop	Time of ploughing	Yield per acre	County
Wheat . . .	January, 1918	6 bushels	Bedford.
,, . . .	January ,,	Failure	Northants.
,, . . .	October, 1917	16 bushels	,,
,, . . .	May ,,	64 ,,	Leicester.
,, . . .	May ,,	48 ,,	Warwick.

Both the Leicestershire and Warwickshire cases were on derelict land and serve to show not merely the advantage of early breaking up and summer fallowing, but also the remarkable possibilities of much land of this description when thoroughly cultivated. The results in these two cases stand out in striking contrast to the others in the table, where the land although not derelict was of much the same character. It is true, of course, that the time of ploughing is not the only factor even on this class of land that determines the result, but the observations of the past two seasons confirm previous experience on the point that to secure the best results from poor pasture on heavy land it is always advisable, in the drier districts of England especially, to break the land up as early as possible. In the majority of cases it would seem that early breaking up is not only advisable but essential if a satisfactory crop is to be grown. Nevertheless, in some instances good crops were produced last season even on this type of land under circumstances which would appear to suggest that the time of ploughing is not of primary importance. To all rules, however, there are exceptions, and experience shows that this is true in a very literal sense in regard to methods of dealing with land. But while the exceptions are not to be overlooked, they do not in this particular case modify what both theory and practice agree in regarding as, in general, the safest course to follow.

The treatment of a summer fallow after the first breaking up will depend to some extent on the state of the land and on the weather. Recent experience shows that when the land is ploughed in May or early June, it is best to leave it in a fairly rough state. In a normal season the sun will not only kill the sod but will so act upon the clods that they can later be reduced to comparative fineness more or less easily. In some recent cases land which had been in grass for forty years and was partially covered with bush was ploughed in May, 1917. It was left in the rough first furrow until after the hay

harvest about the middle of July. It was then cross ploughed and left till the middle of August, when the disc harrow was put over it several times. By the end of August, while it was still rough, the sod had been killed, and there was ample evidence that the soil, unresponsive and stubborn though it was, had yielded largely to the ameliorating influence of the sun and rain. After a thorough rolling followed by disc-harrowing and another ploughing, the land was in condition to harrow down and make a perfectly satisfactory seed-bed for wheat which was sown the first week in October. The crop, which had received a dressing of two cwt. per acre of basic slag applied at the time of sowing, and half a cwt. of sulphate of ammonia in the spring of 1918, was one of the best in the district and in every way equal, and superior to many of those grown on land that had been kept regularly under cultivation.

When a clay soil is broken late in a dry district, not only is the turf not effectively killed, which to many is the main aim, but it is impossible in many instances to break down the soil sufficiently to ensure what may be described as a proper connection between soil and subsoil. In this, as the experienced farmer knows, lies one of the chief secrets of effective tillage. The difficulty is by no means confined to old grass land that is brought under cultivation, but for reasons which are readily explicable, it is often accentuated in this case. One of the lessons of the past season undoubtedly has been the importance of this in its bearing upon the subsequent crop, and it serves to emphasise once more the necessity of early breaking up as one of the main conditions of success.

In the dry districts of the south the early ploughing and fallowing of heavy land is in many instances equally necessary for spring as for autumn cropping. In numerous cases last year where the land was not ploughed till the spring the crop failed. This occurred so often, and the condition of the land in these cases was obviously so unsatisfactory that the failure may reasonably be connected with the time of ploughing. It is true that it was not through ignorance as much as through the force of circumstances that the land was not ploughed earlier, but the value of the result as a demonstration of a principle in farming is not thereby impaired. On stiff clay and where the turf is thick, poor and inferior, it is seldom that the land can be brought into a fit state to be sown with a winter crop if it has not been ploughed up till after harvest. In such cases, except under special circumstances, it will probably be better not to sow in any case till the spring. The experience of last season in many places in the south seems to indicate that even where a spring crop like oats, rather than autumn wheat is intended, success is more likely to follow

where the land has been broken up during the previous summer, than when ploughing has been deferred till the autumn or winter. This, of course, refers to the stiffer and less responsive clays. Heavy land that is not of the stiffest or worst description may be ploughed later even in the south. It is a question of soil, season and method of cultivation, but that there may be considerable variation in the time of ploughing with a corresponding variation in the crop is obvious from last season's results. The following data which refer to various types of heavy land illustrate this point :—

Crop	Time of ploughing	Yield per acre	County
Oats	Dec.—Jan.	24 bushels	Cheshire.
,, ...	January	40 ,,	,,
,, ...	March	32 ,,	Lancaster.
,, ...	February	40 ,,	,,
,, ...	January	50 ,,	,,
,, ...	,,	56 ,,	,,
,, ...	April	35 ,,	,,
,, ...	December	20 ,,	Norfolk.
,, ...	November	Failure	,,
,, ...	Feb.—March	36 bushels	Surrey.
,, ...	Jan.—Feb.	40 ,,	,,
,, ...	December	80 ,,	York.
,, ...	January	60 ,,	Bedford.
,, ...	,,	Failure	,,
,, ...	April	48 bushels	Sussex.
,, ...	March	24 ,,	Suffolk.
,, ...	February	Failure	Hereford.
,, ...	,,	25 bushels	,,
,, ...	March	80 ,,	Berks.
,, ...	February	18 ,,	,,

The variation shown in the table is in accordance with general experience, and it is clear that factors other than the time of ploughing play a part in determining the result. One of these undoubtedly is the degree of consolidation that can be secured by the time the young crop is forming its root system in the soil. Thus on the same type of soil ploughed at or near the same time, the results as shown by the crop may differ widely according to whether the land has been equally well worked and consolidated in all cases. There is some evidence that it is this difference in treatment that accounts for the two conflicting Bedfordshire cases shown above. Proper consolidation not only benefits the crop directly, but is also of great importance in another connection. Corn after old grass frequently suffers from the attacks of wireworm and leather-jackets. Experience shows that the damage from this cause may at least be materially lessened by the consolidation

of the land, partly because this retards the movement of the grubs, and partly because the young plants after attack can re-establish themselves more easily in a well packed soil than in a loose one. On the other hand the excessive consolidation of a stiff damp soil is possible, and failure may follow as in the Norfolk case given in the table. It is true that wireworm is usually less troublesome on heavy than on light lands, but the former are by no means free from the pest. Land that is known to be infested with wireworm if for some reason it cannot be ploughed early, is probably better ploughed late rather than in mid-season. This may account for some of the results shown in the table, which having regard to the situation of the land, would, apart from such a consideration as this, be very remarkable and contrary to the general experience. The experience of last year indicates that it is only in exceptional cases that really good crops are produced on heavy land when the ploughing has been deferred till March or later. While it is impossible to lay down a hard and fast rule on a matter which is subject to so many varying factors, it may perhaps be said that in general heavy soils of fair or good quality are best ploughed in the south and east not later than January for a spring crop. Poor, sour clays cannot as a rule be brought into condition for sowing unless ploughed a good deal earlier than this, and the worst of them, especially in the south, must be broken up during the previous summer. In the wetter districts of the west, genuine clays are not so common as in the drier south. Where they occur, the same remarks in regard to their breaking up apply to a considerable extent. But land, unless in an exceptionally dry season breaks up and consolidates more easily in the west, and even a heavy clay soil may be broken up some weeks later than in the south and give equally satisfactory results. The thorough and skilful working of clay soils, however, is a condition of success everywhere, and to ensure this thorough working early ploughing, or at least relatively early ploughing according to the district and the texture and quality of the soil, is essential.

It may be necessary to add here a word or two in respect of the method of ploughing, especially as regards the type of furrow that should be aimed at under different circumstances. The introduction of the tractor plough and its distribution over the whole country, while it has raised many points of controversy, has settled others more or less effectively. Amongst the latter is the question of the flat furrow in ploughing up old grass. Until the advent of the tractor plough, there were many who would have denied the possibility of good results following a flat furrow, except for a summer fallow. Conviction, however, was brought by force of circumstances, and it

now seems evident that under particular conditions and on many classes of land, a flat furrow is the best means of securing that condition of the soil that is necessary to success with the crop. This applies mainly no doubt to soils ploughed in the spring, and especially perhaps to those of whatever texture that are likely, owing to a thick matted turf or some other cause, to give a loose and "spongy" seed-bed. In regard to the class of land now under consideration, viz., clays, attention has already been drawn to the advantage of a flat shallow furrow in breaking up poor grass on heavy land in the summer, especially in late summer. The object here is to kill the turf through the agency of the sun. Where for any reason this kind of land cannot be ploughed till the autumn or winter the experience in certain cases in the Midlands last season would seem to indicate that the best results under these circumstances follow deep ploughing with an inverted furrow slice. Better results might have accrued in some of these cases had the land been broken up early and summer fallowed, but, as it was, the advantage of deep as compared with shallow autumn ploughing seemed apparent. On good deep soils, with a turf of superior quality, it is the best practice to plough deep and bury the sod in the soil.

Under the abnormal conditions of 1918, much land was undoubtedly broken up later and less skilfully ploughed than it should have been, and it could therefore not be sufficiently worked in time to form a satisfactory seed-bed before sowing. But while the results obtained clearly show that early breaking up and thorough working of the land is, especially the poorer types of clay soil, essential to secure the best crops, they also show as clearly (1) that it is possible to make up to a considerable extent for late ploughing by the skilful use of the disc-harrow, the disc-drill and the roller; and (2) that mere early breaking up without intelligent management subsequently will not ensure success.

Medium Soils.

The lighter classes of land are more easily brought under cultivation than the heavy soils and clays dealt with above. Even on these, however, there is frequently found a thick matted turf which if not thoroughly broken up and rotted may materially interfere with the crop. On the lighter lands, pastures are not usually broken up to be sown with a winter crop like wheat or beans, but for some spring crop. A large area of winter wheat, however, was grown on medium loams last year, and succeeded remarkably well in many cases.

On medium and light soils the time of ploughing is mainly determined by four considerations, viz., (1) the quality of the

turf which will determine largely the degree of consolidation required to ensure a satisfactory crop, (2) the risk of wireworm attack, (3) the general climatic conditions of the district, and (4) the character of the particular season. In 1918 land had to be ploughed as and when farmers could best do it, and as in the case of clay soils the results obtained in many cases were, in the light of previous experience, somewhat surprising. The following data will indicate to the reader how much the local conditions of land and season, the state of the land at the time of ploughing, and the way it is ploughed, must be taken into account in judging the applicability of a general rule in regard to ploughing for a spring crop.

Crop	Time of ploughing	Yield per acre	County
Oats	Jan.—Feb.	40 bushels	Cheshire.
,,	February	60 ,,	,,
,,	January	38 ,,	Lancaster.
,,	March	38 ,,	,,
,,	April	40 ,,	,,
,,	Sept., 1917	20 ,,	Norfolk.
,,	February	80 ,,	,,
,,	January	96 ,,	,,
,,	,,	100 ,,	Lincoln.
,,	March	50 ,,	,,
,,	January	72 ,,	York.
,,	February	60 ,,	,,
,,	Nov., 1917	24 ,,	Bedford.
,,	February	16 ,,	,,
,,	,,	40 ,,	Merioneth.
,,	,,	50 ,,	Sussex.
,,	March	64 ,,	Suffolk.
,,	April	14 ,,	,,
,,	March	24 ,,	Northants.
,,	January	64 ,,	,,
,,	March	60 ,,	Durham.
,,	Dec., 1917	20 ,,	,,
,,	February	45 ,,	,,
,,	May	40 ,,	,,
,,	January	60 ,,	Devon.
,,	March	50 ,,	,,

The above cases are cited mainly with a view to showing the great variation which may be found in local experience, and how difficult at first sight it is to fix upon the best time of ploughing. A further consideration of the results in the light of additional information gives in many cases the explanation for what may seem anomalous. Thus the setting in of dry weather after late ploughing in some instances was responsible for the partial failure of the crop; damage by wireworm in other cases resulted in a diminished crop after early ploughing,

which would probably have been the right thing to do under normal conditions; faulty ploughing which rendered the proper breaking up and consolidation of the land difficult or impossible was mainly responsible in others. While it is obviously easier to secure the necessary tilth in medium and light than in heavy soils, there can be no question as to the advantage in general of early ploughing on these soils also. In spite of many exceptions last year's results, where the conditions were normal, confirm this. It is clear, however, that early ploughing has a different meaning according to the part of the country in which the description is used. In the drier districts of the east and south no land ploughed after the middle of January could be regarded as having been ploughed early, and under normal conditions it is doubtful whether the land could, except with very skilful and somewhat laborious treatment, be brought into the best condition for sowing unless ploughed up by that time. In the north and west, land ploughed a month, or even more, later than this will make a perfect seed-bed without any special tilling operations.

The examples given in the table above all show the variations on medium land in regard to spring-sown oats. The following cases illustrate some of the differences found with wheat sown on the same type of land :—

Crop	Time of ploughing	Yield per acre	County
Wheat . . .	May, 1917	45 bushels	Worcester.
,, . . .	October ,,	32 ,,	,,
,, . . .	November ,,	28 ,,	,,
,, . . .	September ,,	28 ,,	Berks.
,, . . .	February 1918	32 ,,	,,
,, . . .	,, ,,	50 ,,	Suffolk.
,, . . .	October, 1917	40 ,,	Montgomery.
,, . . .	,, ,,	40 ,,	Cardigan.

In the Suffolk and one of the Berkshire cases the crop was spring wheat. In all the other cases it was winter wheat. These like all the other examples given in this article have been taken indiscriminately and are intended mainly to demonstrate the variations in the results obtained on the same type of soil but in different parts of the country. The writer is well aware of the danger of generalising from particular examples, but the cases here given are in many ways sufficiently typical to be of value not merely to illustrate local variations but also in emphasising a general principle. Two points may be noted. In the first place, the advantage of a summer fallow on certain types of medium land is as great relatively as it is on clay. In the second place, the cases from Wales show how

in a moist climate land that is not of the heavier kind can be ploughed out of grass in the autumn and sown before Christmas with every prospect of a satisfactory crop. The two points bear upon the same thing, viz., the proper breaking up of the land so as to form a good seed-bed. While it is generally easier to effect this on medium and light soils than on heavy land, it often happens that on the former as on the latter, an old pasture field has a very thick tough sod which must be effectively killed. Moreover, medium soils no less than the heavier kinds are sometimes sour and in bad physical condition, and the most efficacious way to bring them into a fit state for producing a luxuriant and healthy crop is to expose them thoroughly to the effects of sun, air and rain for a considerable period before the crop is sown, as would be done in a summer or bastard fallow. On land of a genuine medium texture where the soil and the pasture are both of good quality sufficiently good tilth for winter wheat may be obtained after August or September ploughing, and in many parts of the west and north when the land has not been ploughed till October. It is largely a question of the ease with which the land can be broken down and consolidated. Although this varies to some extent with the particular soil to be dealt with and is materially affected by the season, the experience of last year confirms in the main the broad distinction between the treatment of the land in the north and west and in the east and south in order to secure the like results in regard to tilth.

Light Soils.

What has been said in regard to medium soils applies in a large measure to the light soils of the country. Generally speaking, when old grass on light land is broken up and is intended for corn, it is for spring rather than for autumn sowing, and while a variety of crops was grown last season oats very largely predominated. As might have been expected the results varied a great deal even in the same locality, and while there are certain general conclusions that may be legitimately drawn from them, they clearly show, as do the results on other types of land, that the individual field is often a law unto itself and that the experience of previous years did not necessarily hold good in 1918.

Ploughing last season went on from December to May, and both good and bad crops were obtained after early, mid-season and late ploughing according to the quality of the land, the method of cultivation and the state of the weather locally. Examples of this variation, furnished with the same object as before, are given overleaf :—

Crop	Time of ploughing	Yield per acre	County
Oats	February	55 bushels	Cheshire.
,,	January	40 ,,	Lancaster.
,,	March	40 ,,	,,
,,	April	56 ,,	Norfolk.
,,	May	32 ,,	,,
,,	Oct., 1917	15 ,,	,,
,,	March	12 ,,	,,
,,	,,	56 ,,	Hants.
,,	,,	64 ,,	Wilts.
,,	January	40 ,,	Worcester.
,,	December	30 ,,	,,
,,	March	64 ,,	Northants.
,,	February	44 ,,	Stafford.
,,	December	50 ,,	,,
,,	January	64 ,,	Yorks.
,,	,,	56 ,,	Anglesey.
,,	April	20 ,,	Merioneth.
,,	February	56 ,,	Pembroke.

The time of ploughing in the case of light land must, as on other classes of land, depend to a considerable extent on the character of the turf. In many instances the turf is very poor, thick and matted. Under these circumstances it is essential that the land should be ploughed early so that the sod may be given time to decay before sowing time. Where, on the other hand, the turf is of good quality and the land is in good condition, general experience, which is amply confirmed by the particular experience of last year, shows that mid-season ploughing may give equally good results. Even late ploughing, that is, after the middle of March, may give good results unless a drought should set in. This is more likely in the south and east than in the north and west. In general, therefore, it is safer, in the south and east especially, to plough fairly early, although last year in some districts in the south of England, the excellent results obtained after comparatively late spring ploughing were such as to lead many who had broken up grass land for the first time to conclude that late ploughing was the proper practice to adopt. While in high-lying districts and damp climates there is much to be said in favour of late spring ploughing, this does not apply in other districts in a normal season except in special cases. Reference has already been made in an earlier section to what appears to be the undoubted advantage of late, as compared with mid-season, ploughing where the land is infested with wireworm. The experience of the past season showed that special cases of this description were somewhat numerous on the lighter soils. Apart from these and other exceptional cases, the general experience is in favour

of the view that an effort should be made to plough before the end of January in the drier districts, and especially where the land is somewhat raw and is in want of lime, and not later than the beginning of March in the damper districts and the uplands. On many light soils, as on the heavier types, frost has a most useful effect and no advantage that can be taken of this by timely ploughing should be lost. In 1918 there was very little frost during the period of the year when it may be usually expected, and this no doubt may explain in many cases why early ploughing did not seem to give any advantage over late ploughing. In a mild season when there is little or no frost, and when growth starts abnormally early, it is often a positive disadvantage to plough very early on light land unless the work is very carefully and efficiently done, for the ploughed land begins to "grow" badly before it can be sown. This is particularly true of the mild and damp districts of the west and south-west, and for this reason comparatively late ploughing is here often favoured as the normal practice.

Importance of Consolidation.

Stress has been laid earlier in this article upon the importance of thorough consolidation. This is of somewhat special importance on light land, especially where the sod is tough. Unless the sod is well rotted, the land is likely to be very "spongy" often even in spite of a good deal of rolling. In numerous cases last year, apart altogether from any wireworm trouble, a marked difference was observed between the crops on well consolidated land and those sown in a loose seed-bed. Even in the same field, where there had been a difference in the treatment in this respect between one part and another, the superiority of the crop on the better consolidated part was sometimes found to be remarkable.

In order to secure on newly broken up grass land a firm seed-bed and that intimate association between the upper layers of soil and sub-soil which is found in well cultivated tillage land and which exists, it may be supposed, in an undisturbed pasture field, the method of cultivation must aim at the thorough and uniform pressing of the land. Mere rolling, even when repeated many times, will not in itself always secure this end. The time and method of ploughing both affect the matter to a material extent. No amount of rolling can convert a late-turned, tilted furrow-slice on an old and tough grass field into the same firm seed-bed as can be obtained with timely ploughing and a flat furrow-slice. Rolling will be necessary here too, but one rolling will often be as effective as two in the former case. For compacting the soil rolling is essential under all circumstances on land of this description, but never

so essential as when a thick turf has been ploughed late and the weather is dry. The repeated application of the roller is the means by which the disadvantages arising from faulty or late ploughing, or of a dry climate, can best be overcome, and on light land under these circumstances the experience of the past season shows that the operation can hardly be repeated too often. On many light soils, and especially perhaps those on chalk, the land-presser is a most effective implement to use for the purpose of giving firmness to the soil. It is more direct in its effect upon the weak spots in the ploughed surface than the roller. There is no doubt that in many cases last year the use of the land-presser proved to be one of the factors that ensured success both with autumn and spring-sown corn.

In hill districts and other places where corn is sown broadcast, a flat furrow is objected to on the ground that it does not harrow down properly and the seed is insufficiently covered. Consequently the plough is often set so as to turn over a furrow slice with as much of a "crest" as possible. If the land is ploughed at such a time as will allow it to settle down before sowing time and it is sufficiently consolidated by rolling afterwards, this type of furrow may be allowed to have, under these circumstances, much in its favour. But efficient compacting is very necessary, and the later the ploughing the more necessary will hard rolling become, especially where the turf is old and thick.

A further point, which is of somewhat special importance in connection with the ploughing of grass on light land may be referred to. Reference has been made to the difficulty which often arises in mild, damp districts through the grass growing between the furrows on ploughed land before the corn can be sown. By the use of the skim-coulter this can be largely prevented, and at the same time the more rapid disintegration of the turf in the soil and better consolidation by rolling can be secured. There was in some districts last year a considerable amount of land that had got into a bad condition through the cause referred to. It was not always because the land had been ploughed too early ; in some instances it was the result of sowing having been unduly deferred on land that had been ploughed at the right time. In either case, a little more experience in breaking up old pasture would have suggested the use of the skim-coulter in ploughing, and it is certain that had it been used the results would have been far more satisfactory. For ploughing old grass land in the spring in districts where the climatic conditions favour early growth, the skim-coulter is useful on most kinds of soil, and on some it is indispensable.

Some other Causes of Success and Failure.

In the preceding pages attention has almost exclusively been confined to the time and method of ploughing, and how these two factors, on different types of soil, have affected the results which followed the breaking up of grass land in 1918. This has been done advisedly, for although there are other factors which have contributed to the success or failure of crops on newly broken up grass land, the time of ploughing and the manner in which the ploughing was done had directly or indirectly, more to do in determining the success or failure of the subsequent crop than any other cause within the farmer's control. Assuming a normal season, the crop as every farmer knows, is very largely dependent on the degree to which the land has been brought by tillage operations to a proper condition for receiving the seed. In a very great measure, this condition is determined by the manner in which the land was ploughed in the first instance and the time of year when it was done. A study of the results which followed the breaking up of pasture land last year may, therefore, not unreasonably resolve itself to a great extent to the consideration of these two points. It is because of the insistence upon the thorough working and consolidation of the land that the evidence furnished by last season's results shows to be necessary, that the other factors which contributed to the results are, in the present article, given a less prominent place.

One of these other causes which contributed to success in many instances last year was undoubtedly the application of lime. Both on light and on heavy land, lime proved of very great value as an aid to the proper disintegration of the soil and in improving in other respects the condition of many of the sour pastures that were broken up. Its effect was most marked in the case of some of the derelict lands of the Midlands and south of England, and there is reason to believe that the remarkably fine condition to which some very uninviting land of this description was brought both in 1917 and 1918 was largely due to the lime applied to it. In the cases to which reference is made here, the land had been broken up by steam tackle in May, and the lime was spread on the surface at the rate of one to two tons per acre about the end of July, the land being afterwards disc-harrowed. In some instances poor grass on heavy land was dressed on the surface with lime in quantities similar to this before ploughing with a shallow furrow in May or June. Lime has proved equally efficacious on light land, especially where the turf was matted and thick. In the latter case, there is much to be said in favour of applying the lime some considerable time before ploughing. The results would be probably all the better if it was put on

a whole year beforehand. Great advantage, however, was derived from lime on many light and medium soils last season when applied on the furrow and subsequently harrowed in. There is some risk of using lime too freely under these circumstances, and not more than a ton per acre will in general be required. There is a large area of land in this country, both heavy and light, that is very deficient in lime, for which, as a means of improving the condition of the soil, no effective substitute has yet been discovered.

Although in general newly broken up grass land, provided it is of average quality and has been ploughed and worked properly, should not require manuring, the application of suitable dressings of artificial manure was, nevertheless, a contributing cause to success with the crop in many cases last year. In some districts a good deal of poor land was ploughed up, on which, without some assistance in the form of manure, good crops could hardly have been expected, even with the most efficient working of the soil. On many of these naturally poor or exhausted soils, a dressing of from two to three cwt. basic slag or superphosphate and from a half to one cwt. of sulphate of ammonia proved very useful, and its efficacy was not confined to one type of soil. In some cases very good results were obtained from phosphates alone, in which much of the land that reverted to grass many years ago is known to be very deficient. Basic slag was found in some cases in the north and west to hasten ripening and render the corn less liable to lodge, especially where it had been applied to the grass some time previous to ploughing. A dressing of sulphate of ammonia in the spring undoubtedly aided largely in the production of many of the excellent wheat crops that were obtained on the poor clays of the Midlands and south, and prevented failure in many cases with spring corn suffering from wireworm or leather-jackets, or from the bad condition of the soil. Most of the grass land ploughed last year was not manured in any way, but it seems probable that better crops might have been secured on a not inconsiderable proportion of it if it had received some treatment in this respect. As a contributing cause to the success of last year's crops on newly broken grass land, manure, however, is limited in its effects having regard to the country as a whole.

Having drawn attention to some of the more obvious causes which contributed to success, a word may be said finally in regard to certain of the causes, other than those discussed in some detail already, which obviously contributed to failure. The number of absolute failures, from whatever cause, was very small indeed, having regard to the total area involved. There were, however, here and there cases of partial

or comparative failure, which though they did not materially affect the result for the nation, were sufficient to affect the individual farmer more or less seriously.

One of these causes under consideration was that unsuitable land was in some cases broken up. Reference is made to this earlier in this article. Land was undoubtedly broken up in certain cases, which owing to its situation or condition could not by any method of working or manuring be expected to yield good results. Want of experience was probably mainly responsible for this where it occurred, and in some instances perhaps lack of judgment in selecting the land. The pressure of circumstances was such at the time that some mistakes were probably more or less inevitable, and it must, moreover, be recognised that had the season been a different one the results in some of these cases would have been better than they were. But on general grounds, some of the wet undrained land as well as some of the land in elevated situations that was ploughed last year could not have been expected to give results which could add appreciably in any case to the total yield of the country. The fact must be emphasised, however, that the amount of land of a clearly unsuitable character that was ploughed last year formed a very small proportion of the whole, and the effect of this as one of the causes of failure was largely of local importance only.

Another cause of failure in some cases was that crops unsuitable to the particular condition of the land were sown. Wheat, for example, was sown in spring on land where it would have been better to sow oats. Likewise spring oats sown on some of the clay soils in the South of England made an extremely poor growth, while beans sown about the same time, viz., February, and peas sown three weeks or a month later, gave very good results. Rye would in all probability have yielded a good crop on some of the poor light soils where oats were largely a failure. In many instances on rich land corn lodged early in the season and gave rise to substantial loss as well as to much increased labour. Had the land been planted with potatoes the results would have been no doubt far more satisfactory. Scarcely any feature on newly broken up grass land of good quality was more striking last year than the success which in many places attended the planting of the land with potatoes. It is true that disease appeared in some cases, but in spite of a certain amount of loss due to this cause, remarkable crops of potatoes were secured on this kind of land. Provided the sod is broken up sufficiently after fairly early ploughing, or buried deep enough, not to interfere with the after cultivation of the crop, fine tilth is not needed for potatoes. For this reason they are often an eminently

suitable crop for such land as that under consideration not only because of the great food value of the crop itself but also because it is an excellent means of preparing the land for subsequent crops. It may be noted in passing that excellent crops of mangolds were observed last year on some derelict land in the Midlands which had been broken up in the early summer of 1917.

Lastly, some corn crops failed last year because they were sown too late for the conditions of the district. Reference is here made to cases of too late sowing which were not due to late ploughing. Late sowing was inevitable in many instances last year because the land was ploughed late. It has been shown, moreover, that in some cases remarkably good crops were obtained in some districts after very late spring ploughing, and where the sowing must necessarily have been exceptionally late even if done immediately after the furrow was turned. There were other cases where the land had been ploughed sufficiently early, but where sowing was unduly delayed. As it was, the soil became dry before the plant was old enough to have passed its most critical stage and it suffered accordingly. The extent to which the success or failure of a crop is governed by the time of sowing cannot, of course, be determined without having regard to other conditions, such as the kind and variety of crop, the condition of the land, and the season. Apart, however, from these there is evidence that in some instances last year earlier sowing with spring wheat and oats would have resulted in better crops than were obtained.

The failures due to wireworm have already been referred to. These belong to a somewhat different category from those discussed above as they are due to a cause which is only partially under the farmer's control. The experience gained last year with crops suffering from attack will prove useful another season in dealing with similar cases, and will doubtless furnish valuable aid in suggesting measures for generally combating the pest. This applies largely also to leather-jackets which in 1918 were in many instances more destructive than the wireworm. With them as with the latter the value of good tilth and consolidation by rolling has been repeatedly demonstrated.

Many of those who ploughed up grass last year had had no previous experience in dealing with arable land at all. Others though skilful in managing arable land had had little or no experience in breaking up old turf. While there were some failures due to inexperience, mistakes under these circumstances were to be expected, for a man cannot always be asking his neighbour for advice, and when he does the advice is not at all times of the best. As it was, the total failures were

comparatively few, and on the whole the ploughing programme of 1918 was attended with a success that would have been complete had the conditions during the latter part of the season made it possible to reap and gather into security all that the earlier part had promised.

Summary.

It has been the object in the present article to draw attention to some of the points in connection with the breaking up of grass land which may be regarded as being of main importance in their bearing upon the results. In conclusion, these may, for the convenience of the reader, be briefly summarised.

1. While the results were by no means uniform, the experience of last year serves to emphasise as a condition of primary importance the thorough working and breaking up of the soil, and shows that success in the growing of a crop is, apart from the influence of the season, very largely, if not mainly, a question of tilth.

2. This applies to all soils, but is of special importance in connection with the heavier types and in dry districts, inasmuch as it is normally more difficult in these cases to secure proper cultivation than it is on the lighter soils and in the less dry districts.

3. The results obtained last year clearly demonstrate the importance of the time of ploughing as a factor in determining the degree to which fine tilth can be secured, especially on the heavier classes of land and in particular in the relatively dry districts of the Midlands and south of England.

4. While early ploughing is in general to be advocated, cases were observed last year in which the disadvantages of late ploughing had to a great extent been overcome by the systematic and skilful working of the soil subsequently.

5. On derelict land and in the case of inferior pastures on clay and the heavier classes of loam, a summer fallow is generally necessary if it is intended to sow an autumn crop; even for a spring crop last season's experience shows this to be in many cases equally necessary, especially on the clays of the Midlands and the southern districts of England.

6. To ensure success in the growing of corn crops on newly broken up grass land, thorough consolidation by rolling or otherwise is essential, and is of special importance (1) after late ploughing, (2) on light soils, and (3) where there is risk of the crop being damaged by wireworm or leather-jackets.

7. As an aid in securing the necessary degree of consolidation on land ploughed in spring a flat furrow is to be recommended.

8. On the lighter lands, and particularly where the turf is matted and in a damp, mild climate, the skim-coulter is of special value both as an aid to effective cultivation and to proper consolidation subsequently.

9. Apart from the thorough cultivation of the land, the experience of last year indicates that the application of lime and of suitable dressings of artificial manures, especially phosphates, contributes materially to the success of the crop on certain classes of soil in particular.

10. Amongst the causes, other than defective cultivation, which contributed to the failure of crops last season were insect attacks, the ploughing up in some cases of unsuitable land, the planting of crops not best suited to the conditions, and late sowing.

11. While the importance of certain methods of cultivation was amply brought out last year, the many and even striking variations in the results which were clearly due to the character of the season fully demonstrate the effect of season and of local climatic conditions as factors in crop production in this country.

12. The cases in which the crop was an entire failure were comparatively few; the success which attended the effort generally shows the possibilities of a very large proportion of the grass land of England and Wales when put under the plough, and the results moreover prove that even inferior land, may, by thorough working and skilful management, be made to yield in many cases what must be regarded as remarkably fine crops.

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MODERN HAYMAKING AND HAYMAKING MACHINERY.

I. HAYMAKING.

The hay crop occupies an odd position in the scale of national importance as drawn up for war conditions. Secondary from the point of view of human food production, the home supply of hay is of no less importance than corn from the standpoint of the Army Council and other non-producing horse-keepers; and, whatever may be the correct inference, farmers may feed oats and straw without restriction, whereas their hay is subject to a scale of rationing. Weighty arguments could be adduced

against the assertion that the national interest would be prejudiced by the extension of arable cultivation at the expense of the acreage under hay. On the other hand, it is obvious that to ensure supplies for essential purposes in the event of emergency, a certain area must be reserved for this crop.

In some counties meadow hay forms the principal part of the winter ration of all kinds of live stock. The young cattle are fed exclusively on hay, while the diet of the milking stock is varied only by the addition of a little cake and perhaps wet grains. In all counties the hay crop occupies an important place in farm economy, and of the 27,000,000 acres under crops and grass in England and Wales, 4,300,000 are devoted to meadow hay and 1,450,000 to rotation grasses for mowing. How much of this crop could be secured in better condition by the fuller application of accurate knowledge and suitable machinery it is difficult to estimate.

The theory of haymaking is not so simple as it would seem ; unfortunately the experimental ground work is meagre ; and the subject has received little attention from modern specialists in the several branches of science concerned. Anything herein which purports to be a scientific explanation is, therefore, offered with that reservation. The process is certainly not comparable with the drying of inert material.

Meadow plants consist of "cells," some of which contain protoplasm while others are lifeless and act as stays and water conduits. The latter are found chiefly in the leaf veins and in the woody parts of the stem. Up the wood vessels passes the water current, bearing in solution the salts required by the living cells, which absorb the salts and pass on the surplus moisture to the intercellular air spaces into which it evaporates. From here the water vapour escapes into the atmosphere through the stomata with which the under surface of leaves and the skin of stems are perforated. Stomata have the power of opening and closing according to whether the plant requires rapid or slow loss of moisture. A certain amount of moisture also escapes by simple evaporation from the plant surface, while a special open pore at the tip of the leaf of grass plants allows of the exudation of water in the liquid form commonly regarded as a drop of dew.

After grass is cut the process of transpiration continues until the loss of moisture affects the stomata and causes them to close. Doubtless a fair proportion of the moisture is drawn from the stems and given off in this way, but the exact part played by the stomata in this connection appears not to have been determined. If they close when the leaf

wilts, then they must prevent the escape of moisture. American writers attribute to them, however, one of the advantages of cocking: when partly made grass is gathered into cocks the flow of moisture from stem to leaf is supposed to continue, and when the cocks are opened out the rapid drying of the hay is to be regarded as due to the escape of moisture through the leaf stomata. It may be the case that stomata open again after a certain degree of wilting has taken place, but this point requires experimental confirmation. It is perhaps more likely that the shrinkage of the tissues on partial drying renders the outer coverings of the plant porous.

How much of the moisture escapes by evaporation from the cut end of the stem is another undetermined point. Certain practices in hay and corn harvesting suggest that this exit is important. Sheaves of corn win rapidly when the butts are laid towards the sun or wind or placed in small field stacks with every butt exposed; and even "seeds" herbage which has little bottom leaf is "turned" butts first. In both cases there are other considerations which render these practices desirable, but there are botanical reasons for an assumption that much of the free moisture of the plant can make its escape from the cut ends. The wood vessels there exposed to the air are in direct and almost free communication with all parts of the plant structure; and being devoid of protoplasm the resistance, which this substance would offer to the movement and loss of moisture, is absent.

The resistance offered by living protoplasm to the loss of moisture probably explains the longer exposure required to convert young or leafy herbage into hay, apart from the fact of the greater moisture content. It may also be the case that in older herbage the greater development of the wood-vessels allows of the more rapid movement of moisture; for it is well known that as grass matures the proportion of woody matter increases. Similarly the difference in the percentage of crude fibre in coarse grasses and in clovers corresponds with the difference in the length of exposure necessary to dry them.

During the outdoor drying processes considerable losses occur. According to Kellner 10 to 20 per cent. of the dry matter is lost even in the most favourable harvest weather. Apart from "mechanical" losses—the breaking off of the tender and rich fine parts—there are others less perceptible but having even greater effect upon the quality and nutritive value of the hay. The former depend largely upon judgment in the matter of time of cutting and manner of handling the hay; the latter are more dependent upon the weather.

Farmers do not feel so much concern about the effects of rain or dew on grass lying in the swath as left by the mower, provided fine weather comes before the underside begins to turn yellow, and the stuff begins to smell. It may not, therefore, be pleasant to know that there is cause for concern, and that the only preventive is to retard the mower. If the material does not dry much the cell protoplasm remains alive for some considerable time. In maintaining life the readily available cell contents are gradually consumed (in the process of respiration), and the younger and more nutritious the grass the greater is the loss. Obviously, therefore, the sooner the grass is dried and secured the better. Other considerations in support of this will be obvious after the questions of curing have been considered.

The effects of rain on partly dried grass are better known. A heavy shower at the windrow stage may completely destroy the colour, and seriously affect the aroma. External moisture also creates two pitfalls. On the one side there is the danger of producing a sample that cuts up brittle and dusty, as a result of eagerness to dry the hay sufficiently ; on the other side, to stack the hay damp will result in musty or mouldy and bitter character. The questions of loss of colour and aroma are too subtle for present explanation, and the other defects will be dealt with later. Attention may, however, be called to the solvent action of rain upon hay. Everyone knows that much of the nutritive matter may be extracted with soft water, particularly if the hay has previously been chaffed or mutilated. The action of rain upon hay that has been roughly handled is identical. The theory about the destruction of the wax (or silica) coat by the acts of swath turning or tedding does not, however, explain the matter. So long as the protoplasm is living it can resist the solvent action of rain (beet cells have to be killed before the sugar can be extracted), but after a time, and as drying proceeds, the life-resistance ceases, and it is for this reason that the material becomes liable to leaching. Rough handling breaks the stems and leaves and makes large openings, and in that way facilitates the entry of water. But in normal drying the tissues become porous, either by the re-opening of the stomata or by the production of minute fissures in the surface layers as a result of the shrinking. A dry or partly dry swath is subject to injury by rain, but to a less extent than turned or scattered hay, because the top layer of an unmoved swath lies in a thatch-like posture.

Reverting to the questions of colour and aroma. These are attributable to the presence of small quantities of complex organic compounds. The leaf green matter (chlorophyll) cannot be dissolved out of a living cell, and even if the cell is dead

pure water will not extract it. Alcohol will dissolve it, and acid will destroy the greenness. Possibly a trace of alcohol is produced within the cell in ordinary drying, and this assists the rain. In protracted drying acids are formed, which act upon chlorophyll and change the colour to a yellow shade. The aromatic compounds include coumarine, which occurs in sweet vernal grass particularly. This substance is slightly soluble in water, and very soluble in alcohol.

The aim of the field operations is to bring the hay into such condition as the farmer's judgment determines to be "fit to carry." The quality of the finished product depends absolutely upon the accuracy of this judgment and the practical possibilities of acting up to it. Weather conditions may and often do defeat the farmer's aims, and cause him to take chances which are perhaps not in the interests of the particular part of his hay crop under treatment at the time. In such cases he brings the hay as near to the ideal condition as he considers practicable. On the other hand there are many whose observation has never been properly exercised as an aid to their judgment, and even the best hay maker would benefit from a correct understanding of the scientific principles underlying his work.

Sweating in the stack continues for some five to eight weeks after carrying, the length of time depending upon the size of the stack and the amount of moisture present when the hay is put together. Some difference of opinion exists as to the nature and causes of the changes that take place, but Miehe's experiments at Leipzig (of which a *résumé* appears in the February, 1912, number of the Board of Agriculture Journal), appear to settle the question as to the cause. By demonstrating that hay sterilised with steam or chloroform was incapable of spontaneous heating until a little ordinary hay had been added, he proved that the cause was biological. He also proved that a supply of oxygen and the presence of moisture were necessary conditions, while a water content of 25 per cent. led to considerable temperatures. (Grass at mowing contains 60 to 70 per cent. ; cured hay contains about 15 per cent. of moisture.)

If the plant cells are still alive at the time of carrying (as is not unlikely when the drying process has been rapid), the first stage in the heating is attributable to the respiratory activity of the protoplasm. The latter is, however, killed by a temperature of 100° F. But dead organic matter is capable of hot fermentation (hot-beds, for instance), and Miehe isolated an organism (Bacillus coli) which caused a rise in temperature in dead hay from 64° F. to 107° F. He attributes chiefly to this organism the fermentation up to the latter temperature. He found, however, that two common moulds were able to cause

heating up to 140° F. in the case of the white kind, and 112° F. in that of the black mould. The most active organism of all was Bacillus calfactor, which was mainly responsible for the fermentation between the temperatures of 104° F. and 167° F. Any further heating after the latter temperature had been reached was due to purely chemical oxidation.

It remains for the future investigator to prove exactly the effect on the quality of the hay of the activity of each of the above mentioned kinds of organism. There may be others concerned such as Bacillus subtilis (common on dusty hay), and it is desirable to know the conditions specially favourable to each. The opinion may be here ventured, however, that in the case of dead hay containing too much moisture at stacking, the fermentation at the lower temperatures favourable to Bacillus coli and the moulds is prolonged; the effects of the putrefactive bacillus (coli) and the fungi are afterwards seen in the musty, mouldy, or bitter character of the hay. If hay is not dead at stacking and is led while enclosing warm air the temperature rises quickly and the stage is soon reached at which the more desirable organism comes into activity and supersedes the undesirable kinds. In a large stack built slowly and not well trampled down, hay still living and containing sufficient moisture may attain a temperature at which ignition takes place.

Over-heating of stacks is most common in seasons when weather conditions have favoured rapid drying. The usual explanation is to the effect that the sun seals up the juices within the plant and the farmer is deceived as to the actual dryness of the hay. This theory is, like most of those held on matters connected with haymaking, simple speculation, and incapable of explanation. Mere rapid drying cannot seal up the pores of the plant, and the feel and sound of the material are reliable indications of the moisture content. The most likely explanation is probably that of the more complete preservation of the readily available contents of the cell, the retention of a certain amount of life in the protoplasm, and the entrapping of warm air at stacking. In less favourable weather the protoplasm respires away, during the long period of drying, a portion of the soluble ingredients within the cell: the respiratory activity diminishes, and the temperature at stacking is lower. When, on the other hand, the drying process has been rapid, less of the life energy and heat have been lost; and the material soon attains the temperature at which Bacillus calfactor comes into action. Various methods are adopted to reduce the heat or check fermentation when there is danger of over-heating, and nothing new is here specifically suggested. One has received favourable

testimony of the value of boring holes down from the roof of the stack: on the other hand, there would seem to be risk under certain conditions of producing local heat by the friction involved in the cutting. The effect of salt in checking fermentation is due chiefly to its antiseptic action. It may, however, assist by itself abstracting or absorbing the moisture.

Over-made hay is liable to cut up dusty. The dust in this case is due less to the spores of fungi than to the mouldering down of the tissues of the plant as a result of its brittleness. Old hay naturally tends to become somewhat dusty because of the further drying; hay that is over ripe at cutting has become brittle and liable to crumble: and certain kinds of herbage are very prone to produce hay of dusty character: lucerne, red clover, and tares are in this category.

The chemistry of the curing process is another problem for the research worker. That the principal feature is oxidation has been clearly proved, but the nature of the changes is still incompletely known. The old theory is that the starch is changed into sugar, then the sugar is oxidised into alcohol, which similarly becomes acetaldehyde, and if the hay is wet this on oxidation forms acetic acid. According to this theory the aim should be to have only sufficient fermentation to convert the starch into sugar, and if the heating goes too far there will be danger of fire because of the acetaldehyde produced.

It is possible that to some extent sugar, alcohol and aldehydes are produced, but such investigations as have been made suggest that the process is more direct, and that the carbohydrates are completely oxidised to carbon dioxide and water. Some of the water vapour escaping from a sweating stack arises from this source. While the loss falls chiefly upon the starch and pentosans, the proteins also suffer; the result is that the hay becomes poorer in these constituents and richer in crude fibre. The digestibility of all constituents is also affected, particularly when the hay has been heated brown.

Little importance can be attached to the theory as to the production of sugar by a limited fermentation, but it is clear that, from the chemical standpoint, the less the fermentation the more complete is the conservation of the nutrients after stacking. On the other hand, if the hay is made so dry before carrying that it will not sweat in the stack, it will cut up dusty, odourless, unpalatable stuff; and, although analyses are not available, it is not unlikely that considerable losses take place in the field before that condition is attained, apart from the

loss of fine parts, and the prolongation of the weather risks. This does not apply to the gradual curing in cocks before leading, or to stacking in small stacks. In both cases some fermentation takes place, but owing to the easier escape of moisture and heat the temperature does not rise so high, and the heating process is not so prolonged as in a large mass of hay.

The degree of heat desired in the curing varies in different districts. In Scotland the aim is rather to prevent heating, while in the South of England a certain amount of browning is desired. If the hay has been led direct from the windrow the temperature should, according to the bacteriological considerations already given, rise fairly quickly above 107° F., but heating above 140° F. is undesirable, and browns the hay.

It is not a difficult matter to ascertain the temperature inside a stack, but it is less simple to determine or to define the correct condition of hay at stacking. There is no simple and reliable test, and moreover, the degree of dryness must be varied according to the nature and kind of crop. Kellner says : "It is preferable to continue the drying until the plants begin to rustle when they are handled, but the leaves should remain tough and not brittle, and the stems green, but containing little sap." Todd's succinct paragraph may also be usefully quoted :— "Coarse rye grass and cocksfoot hay may be carried as soon as it is dry to the touch and before it has become at all brittle, and the same may be said of permanent grass from poor land. Sainfoin and red clover are fit to carry as soon as the leaves are crisp and the stalks withered ; but lucerne, trefoil, tares, and the grass from rich pastures, require to be thoroughly dry in every part before they may be stacked with safety."

Different systems of haymaking are followed in different districts and in every district the details have to be adapted to the varying conditions of weather, nature of herbage and weight of crop. Generally speaking, however, the practice in any given locality is based on one or other of the following systems ; and although in very fine weather the north country farmer may be tempted to lead direct from the windrow and in catchy weather the Midlander may put the hay up in cocks, they hesitate before departing from their regular practice.

The systems are :—

(*a*) Curing in the windrow—Midland practice.
(*b*) „ „ cock—North Country practice and old Middlesex plan.
(*c*) „ „ small field ricks—Scotch and Irish practice.

In illustration of the above three systems typical examples are here given showing the operations day by day when there

is no interruption by unfavourable weather. An average crop of old land grass is assumed in each case.

	(*a*) Derbyshire	(*b*) Yorkshire	(*b*) Middlesex (Wrightson, 1891)	(*c*) Scotland
1st day	Cut	Cut	Cut	Cut
2nd day	Turned with swath turner	Turned with swath turner	Tedded, twice turned, raked together and made into grasscocks	—
3rd day	Turned with swath turner (Windrowed and led if ready)	Turned with swath turner; raked into rows and made into cocks	Thrown out of grasscocks into staddles, the staddles are turned once or twice and raked together into double-sized cocks	Turned with swath turner; raked into rows with slide rake and "hand coled" (cocked)
4th day	Side raked into 2-swath rows, then into 4-swath rows. These are moved to and fro with side rake until ready for leading	Cocks spread out and tedded. Gathered and cocked again	The large cocks are thrown out into larger staddles, turned and raked together for carting to the rick or possibly for making into cocks again	Hand coles carried into "tramp coles" or "tramp ricks" containing about a cart load. These remain out in the field for about a month
5th day	—	Cocks opened out and carried	—	—

(*a*) Curing in the windrow is not a new system, although owing to the introduction of the side delivery rake and the hay loader it has rapidly extended in recent years and has come to be recognised as the best and most economical system for the greater part of England. Marshall, writing about a century ago, denounced the practice as he saw it in Leicestershire and Derbyshire, where much hay was spoilt by being left in the row exposed to spells of bad weather. His remarks are still applicable in some cases, where there is a tendency to leave grass too long in the swath waiting for the necessary two good days which will make it fit to lead out of the windrow, or where hay that does not come into condition as intended is left

in the row to take its chances through a risky night. In the one case hay is badly weathered which could have been secured in fair condition by watching opportunities and working on the cocking principle ; in the other case the hay might be run together into cocks during the afternoon, especially if there is reason to expect rain during the night.

If the windrows do not cure fast enough for leading on the day they are made, and if there is no likelihood of rain falling during the night, then the decision as to whether the hay should be heaped or not should depend upon the amount of dew to be expected. A heavy dew may do considerable injury to the quality, and unless precautions are taken to bring the material into very good condition next day there is risk of producing a musty and mouldy sample. On low lying land and in certain districts it is very unsafe to leave hay in row over night ; in other cases the little harm that would result is of smaller moment than the cost of cocking and opening out again.

When weather conditions permit of straight forward working the windrow system admits of the hay being secured with the minimum of hand manipulation : machinery can be used at every stage, and, without subjecting the hay to rough usage, it can be secured in the least time. In the best weather the side rake may begin to work on the third day and the loader or sweep may clear the field before night. The system depends, however, upon the virtues of the side delivery rake, which makes a light airy row and constantly moves it over on to fresh ground, at the same time preventing the sun from scorching any of the hay. The dump rake is of little service for this purpose. It is when the hay does not dry as fast as it was intended that the farmer is apt to find himself in difficulties, and many would appreciate the results of disinterested experiments on the point of whether it is safe and practicable to carry hay in "gay" condition if ventilating chimneys are cut down into the heart of the stack.

(*b*) Curing in the cock is extravagant of hand labour and does not readily lend itself to the economising advantages of machine work. For these reasons the practice is becoming restricted to districts in which local climatic conditions require it, and in other districts to seasons when the weather is "catchy." Where the rainfall is in normal seasons relatively heavy during the months of May, June and July, as is the case in north-western and western counties, the herbage is more watery and the soil contains more moisture ; consequently the drying process is slower, while, owing to the liability to untimely changes of weather, it is unsafe to give the half-cured hay much space or to leave it abroad over night.

The question of keeping out dew has already been touched upon. In this system, where properly understood, care is taken to make up the cocks while the atmosphere is still warm. If the operation is delayed until the stuff has become chilled and the cocks entrap cold, damp air, the advantages are lost.

In dealing with coarser material, such as "seeds" hay, the process is more direct, the opening out and tedding typical of the fourth day in the case of finer grasses is omitted. In some districts also meadow hay is allowed to lie an extra day or two before turning, and is therefore less "gay" when put into cocks. Instead of opening and tedding these out, they remain in the field a week or so to condition themselves. The modification saves labour, but produces a hay that does not sweat and settle so well as in the typical process. The colour is also not so well preserved, and it is one of the claims of the Middlesex method that when properly carried out it results in a hay retaining most of the original greenness.

(*c*) The Scotch system is made less laborious than would at first sight appear, owing to the general use of a series of special appliances. When it is necessary to make "hand coles" (or cocks) hand labour is involved, but this is economised by the use of hay collectors. When the hay can be taken from the windrow the same implement is used to sweep it to the tramp ricks, which are built in a line across the middle of the field, two to four per acre of hay. Various ways of collecting the hay to form these ricks are, however, adopted. Sometimes the cocks are carried bodily in stretcher fashion, sometimes they are "swept" up, and sometimes the ricks are built on the platform of the hay bogie as it moves along, and slipped off behind. When the ricks are to be carried they are either hauled bodily on to the bogie or hoisted by a tripod rick-lifter on to a cart (both of which are expeditious operations), and unloaded at the stack with the aid of a horse fork.

This system is specially suited to Scotch conditions. It admits of the hay being rapidly made secure against the weather, thus taking full advantage of favourable conditions as they present themselves ; at the same time the staff are early liberated for work amongst the root crops. The field ricks are carted home when the roots have been dealt with, and before corn harvest begins.

The hay having stood (on bottles of straw) in the field for two or three weeks does not sweat much when stacked. It would not, therefore, please southern horse-keepers.

II. HAYMAKING MACHINERY.

No branch of farm work has afforded greater scope for the application of mechanical genius than the saving of the hay crop, and in no department of agriculture have methods undergone such changes as a result of the introduction of machinery. In contrast with the tedious processes performed wholly by hand in 1860, and normally involving the consumption of two gallons of beer per acre, modern haymaking on the larger farms is a succession of machine operations carried out very rapidly during the periods of fine weather.

The tedder and the horse rake had become practical machines before 1860, when the mower first began to merit general adoption, but little real use could be made of these or any other haymaking inventions until the rate of cutting had been increased. In about twenty years the above three machines had become part of the regular equipment of farms. Shortly afterwards the horse fork, and in Scotland the rick lifter also, were added, and about 1890 Speir and McConnel introduced and adapted the sweep-rake. By this time the elevator had attained wide distribution, and the swath turner was placed before the farming public in 1896. The hay loader was devised in America as early as 1875, and has been known in England for at least fifteen years, but it is only quite recently that the British farmer has been offered a type suited to his conditions. The side-delivery rake and its adaptations are the latest additions to the list of successful machines, but the past fifteen years have been rich in variations and general improvements of most of the implements used in the hayfield. Patents have now been taken out for machines designed to gather and deposit hay in cocks which, if successful, should have a great future.

Mowers.—The mower has been standardised for many years, and has attained such a degree of perfection in design and construction that the draught of machines cutting an eight feet swath is within the power of two horses. Amongst the more or less recent improvements may be mentioned roller and ball bearings, renewable bushings, hardened or renewable plates to take up the wear of the knife on the bar, and a finger bar that is very flexible, and is operated by means of a foot lift. Various makers emphasise different details, such as a ball and socket joint between the rod and the blade, and adjustability in the length of the connecting rod and the bars which brace the finger board in alignment. Machines with high and low speed gears may also be had; while the wide cut variety already mentioned is made to be of special service where considerable areas of rotation hay are grown on level land.

The light weight machine has demonstrated its utility under a wide range of conditions. The weight being concentrated on the main wheels, these are enabled to obtain sufficient purchase for driving the cutting mechanism ; but naturally a somewhat slender construction incurs greater liability to disalignment ; and when the wheels begin to wear smooth, they tend to slip over the stubble unless the cutting parts are in perfect adjustment.

Little importance can be attached to the claim that a horizontal crank-shaft gives a more direct drive ; the same is claimed for the opposite arrangement. It would seem that the conflicting evils of twist on the crank-pin and indirect longitudinal thrust on the knife could only be overcome by the introduction of spur gearing between the crank-shaft and the disc which gives the motion to the connecting rod ; but the disadvantages of this would probably outweigh its merits.

To ensure the perfect working of the mower the knife caps and fingers require attention from time to time. A bent finger will cause a line of long grass to be left, and if there is too much play between the blade and caps it will not cut clean, even though proper attention be paid to sharpening. When it is necessary to have a connecting rod repaired locally, it is as well to make sure that the smith understands the importance of preserving the proper length to ensure the blade "registering" correctly.

Tedders.—The hooded rotary machine and the kicker or shaker are both very familiar appliances, and have undergone little modification since the Society's Darlington trials (*R.A.S.E. Journal*, 1895).

The inherent objections to the common rotary type are its unsatisfactory work on uneven land, and its rough treatment of the hay. On the other hand it is durable, and can be used to toss material that neither a swath turner nor a side rake could deal with. The need for this sometimes occurs in a wet season.

In districts where the hay is cocked and opened out, some form of tedder is needed for meadow crops.

The kicker handles the hay less roughly, and is therefore not unsuitable for making clover hay. The earlier difficulties of working it on ridge and furrow are overcome by the device of a divided frame ; and probably with such improvement the machine is one of the most useful of the general purpose haymakers.

The new "Lion" Tedder, awarded the Society's silver medal at the Nottingham (1915) Show, is the one material advancement in tedding machines since the 1895 trials, and will also doubtless become the standard haymaker on farms with an insufficient acreage of hay to justify the purchase of

separate machines. Being fitted with flexible spring tines, rotating eccentrically round an axis placed near the main axle, the machine can work close to the ground and follow regular undulations. It handles the hay gently, and the draught is comparatively light.

Swath Turners.—This is an English invention, of which several modifications have been introduced since 1900, and the choice of a make is largely a matter of opinion and local experience. Reversible machines have the advantage of being useful for collecting the hay into small windrows, and may therefore be more serviceable than the non-reversible, where a side-rake is not available. On the other hand there are many farmers who prefer the simpler type on account of its greater efficiency and durability, and lighter draught.

The swath turner gently inverts the swath intact on to the dry interspace, as distinct from the tedder, which scatters the crop broadcast. The operation can be repeated until the swath has dried through; and in the case of "seeds" hay the crop may be cured ready for leading with the aid of this implement alone. With finer grasses, however, particularly when the swaths are heavy and damp, it is sometimes impossible to secure uniform drying without breaking the swaths open either by hand or with a tedder.

The gentler treatment of the hay and the preservation of the swath diminishes the risk of injury from inopportune rains, and when the interspaces have dried, the crop can be turned over on to them, whereas if the crop had been scattered broadcast the ground would lie damp for a longer time after rain. Most farmers consider this machine indispensable.

The Side-delivery Rake.—This machine is probably of Trans-Atlantic origin, but has been manufactured in England since about 1905, and is still a subject for the improver. There are two types. In the one the rake bars are placed behind, and obliquely to the main axle. In this case the driver is in front of his work. The implement is of rather cumbersome size, and, excepting the make in which the defect is overcome, the "bite" of the rakes is adjustable at the rear end only. The oblique setting of the rakes, however, allows of the direct sideways movement of the crop without any portion of it being carried forward and handled several times by the machine. In the later type of machine the rakes are suspended in front of and either parallel or obliquely to the main axle. The machine is much narrower between the main wheels, and for both these reasons the tines can the better follow the variations in the surface of the ground.

The virtues and uses of the side-rake are explained in an earlier section dealing with curing in windrow, for which

purpose it is invaluable, and on many farms indispensable. The writer knows of no recent invention which farmers appreciate more than this. The row lies light and airy, and is easy to gather for cocking or pitching ; the machine is light in draught and easy to operate, and it enables the farmer to gather and carry first from such parts of the field as may be ready, without including suspicious material. The writer has also seen the side-rake used to considerable advantage in collecting twitch on light land scheduled for improved cultivation.

The Combined Haymaker.—The most recent development of the reversible side-rake, for the purpose of making it serviceable at all stages in haymaking is that described at page 240 of the 1915 number of this Journal. Given reasonably uniform land, this machine will satisfactorily perform either of the separate operations of swath-turning or side-raking, and do useful service in tedding. On many farms it will be a complete equipment in itself, but on holdings producing considerable areas of hay separate machines are required rather than duplicates of this.

Hay Collectors.—The term collector is here used with reference only to appliances that are serviceable for collecting hay into heaps. The well known slide or tumbler rake can be used for this purpose, and larger quantities can be carried on the miniature sweep, which consists essentially of six flat wooden spokes about three feet long, projecting at equal distances from a substantial beam about nine feet in length. The latter tool is extensively used in northern districts for collecting hay into tramp ricks, but it is certainly of considerable service elsewhere when it is necessary or desirable to make large cocks.

A patent has been accepted whereby a side delivery rake is converted into a collector. The device is simply that of long curved tines, which carry the hay forward as it leaves the delivery end of the machine, the load being released by depressing a foot lever, which raises the collecting tines.

Northern hay-makers will be more interested in the attempts which two or three inventors are making to devise a machine that will mould the hay into the form of a well shaped cock. Patents for such have been taken out. The hay is delivered into a conical receptacle, and is tramped down by a man, who when the receptacle is full inverts it, and deposits the cock on the ground. There is room for a machine of this kind.

Hay Sweeps.—The distinction between collectors and sweeps is chiefly that of size. The simple wheelless implement above mentioned is used as a sweep in some districts, and in the hands of a capable operator is one of the most useful for

rapidly clearing a small field in which the hay is to be stacked. An improvement upon the simple collector is one with longer teeth, a rack behind, and running on small wheels. This machine is capable of carrying considerable quantities of hay and would meet the requirements of many farmers who have not sufficient work for a full-sized two-horse sweep. There are also various local devices which answer the purpose of carrying the hay to the stack without having to fork it on to carts; and one of the most satisfactory is that made in the shape of a simple fire-guard, and hinged at the two corners.

The English sweep-rake in its latest form is described at pages 159 and 160 of the 1916 number of this Journal. In America a special type is used in conjunction with a stacker, which hoists the load bodily on to the stack. The horses are yoked behind the implement, and the load when full is run on to the teeth of the stacker.

The hay-sweep is only of service where the hay is stacked in the field, unless, of course, there is suitable access from the field to the homestead, for it cannot pass with a load between points less than 15 ft. apart. Under suitable conditions, however, it is the most expeditious and economical means of leading hay. One man with a pair of horses can load out of cock, windrow, or even out of swath, if necessary, and the load can be deposited at the stack by simply backing the horses.

The labour saving merits of this implement have led to attempts to devise a form which may be of service in leading the hay home through ordinary gateways. The form in question is a one-horse contrivance, with very long shafts, and is only about half the width of the standard implement. Experience of its use will be of interest. Another inventor has devised means which are intended to render the sweep applicable to uneven land.

Hay Loaders.—English farmers have spent considerable sums in experimenting with unsatisfactory types of hay loader; and although there are a considerable number of the endless-web type, which give their owners much satisfaction, the fact is gradually emerging that the original "shaker" form is the more suited to English conditions.

Three varieties of the apron or web-type have been tried, and all have worked well on even land when capably handled, but many farmers have had trouble with the hay winding round the collecting drum, or returning with the carrier on the underside. It has, however, the advantage of gentle treatment of the hay.

The shaker type is now represented in this country by two English makes, and by a somewhat similar Canadian product. Its manipulation does not call for special skill; evenness of

the windrows is not quite so important, and even if the hay is not promptly removed as delivered at the wagon it will not be carried back.

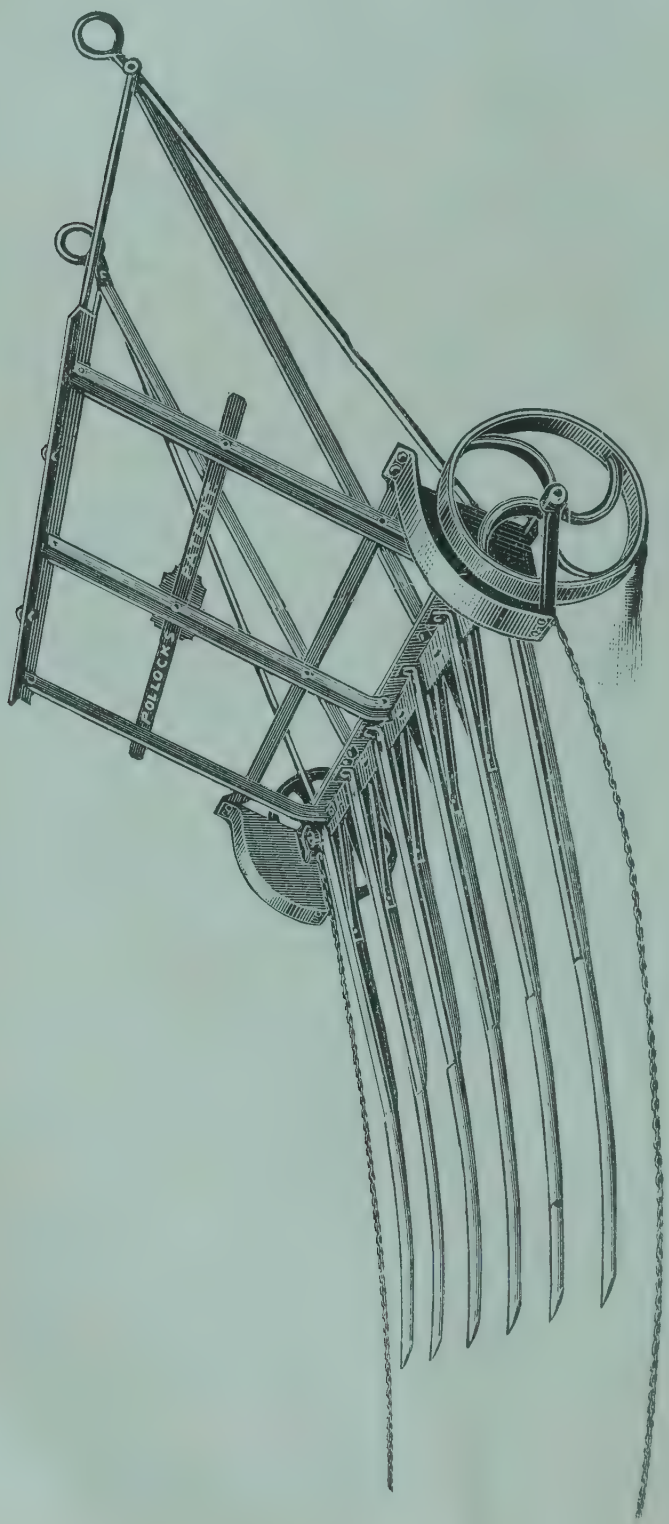


FIG. 1.—Hay Sweep.



FIG. 2.—Hay Loader.

The hay loader is a machine which the large farmer cannot well dispense with if he leads his hay home from the windrow, or if that method would be applicable to his conditions. Some form of hay-holder is necessary, to be used in conjunction with the loader.

Horse Forks.—It is most frequently at the stack that leading is delayed, for although one man can unload more quickly than another can fork on to a cart, he cannot well keep pace with two pitchers.

The fork is made in a variety of shapes. The double harpoon is, however, the most popular, although the clip and the derrick patterns answer better for dealing with short material. An interesting patent was taken out a few years ago, but apparently not adopted, which was to have spread the hay about when releasing it. This if successful would have met a good demand, for there is a tendency not to spread the fork-loads sufficiently. In America slings built in with the load take the place of the fork to some extent, the hay being deposited by opening a catch which releases the two halves of the sling.

In barns of suitable construction a track and carrier are the best elevating contrivance for use with a horse fork. For out-door stacking a single inclined pole or one of the several proprietary outfits may be used. Of the latter the swinging crane type is the most generally useful, being easy to erect, and suitable (in its latest form) for work under Dutch barns.

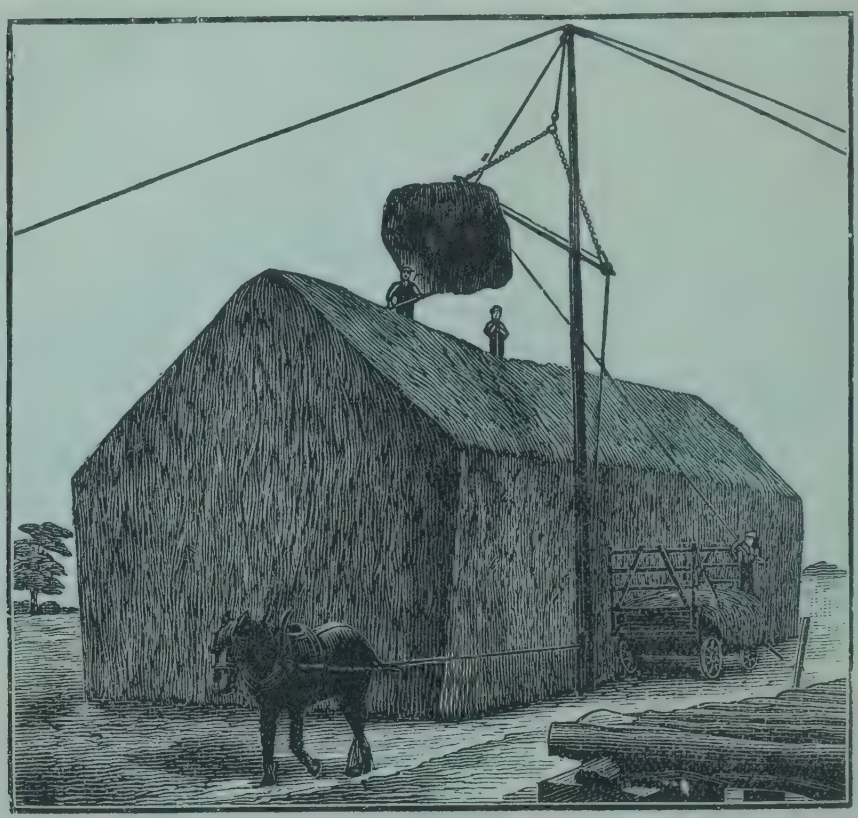


FIG. 3.—Horse Fork.

In barns with substantial roofs a single pulley may be all that is necessary, although a second attached to an upright will assist.

To work the implement there must be one man on the load, another to direct the fork on the stack, and a boy driving the horse. It will pick hay up off the ground after a hay sweep, although not so well as out of a wagon.

Elevators.—On farms where there is also a considerable acreage of corn, it would be economical to purchase an elevator instead of a horsefork. When unloading into an elevator, one man can push the hay off sufficiently fast to keep three stackers busy and the horse-boy can be dispensed with.

Elevators are made in different sizes to suit the requirements of different areas, or rather to deliver to different heights; and they may be either operated by horse gear or driven by an engine. The latter is not necessarily the more economical. The "adjustable hopper" is a convenience, particularly for use with hay sweeps, as it saves labour in pitching the hay, until the stack attains such a height that it is necessary to move the trough upwards.



FIG. 4.—Elevator.

The Rick Lifter.—This is a north-country adaptation of the arrangement used for hoisting trees on to the timber waggon. It consists of a large tripod on wheels with block and tackle and four grabs. The tripod is placed in position over the tramp-rick, the grabs are pushed in below the hay, and a horse hauls the rick high enough for an ordinary cart to be backed under. Loading by this method takes five minutes at the most; and the implement is a great boon to farmers who make hay on north-country lines.

The Rick Carrier.—The rick carrier or hay bogie is a low platform on broad wheels, on to which the rick can be bodily hauled and carried away. It is backed up against the base of the rick and tilted rearwards ; a rope or chain is passed round the rick, and (in the improved type) by means of a windlass at the front of the vehicle the rick is drawn on to the platform, which returns to its horizontal position, and is then secured by means of a suitable catch.

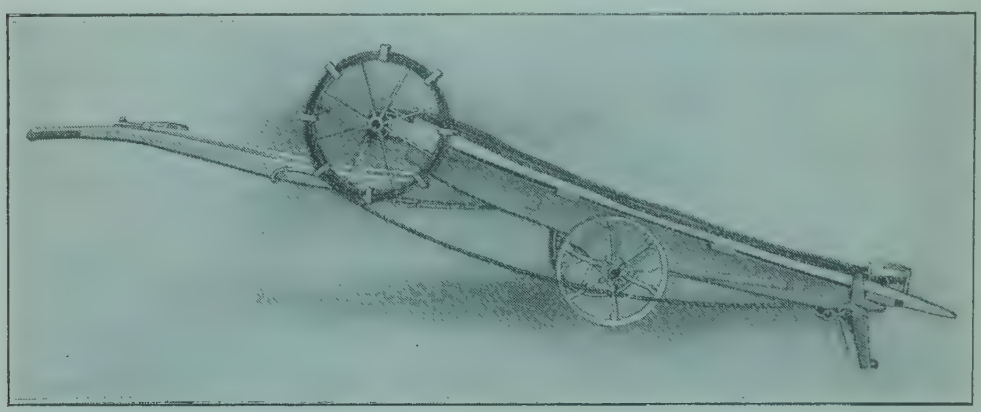


Fig. 5.—Rick Carrier.

One man and a horse can quickly load a large quantity of hay in this manner ; and besides being of service for transporting sheep, &c., the bogie can be used for carting green material to the homestead. It must, of course, be fitted with crate sides when leading cabbages, but when carrying material for ensilage, the weight of which makes pitching on to carts laborious, no side rails are necessary.

Economics of Haying Machinery.

Few farmers require or could economically invest in all the appliances of proved merit that are available for use in the making and carrying of hay. Hay-making tackle is, like many other parts of farm equipment, used during a relatively brief period ; it stands idle for the rest of the year, taking up valuable space, depreciating in value and incurring interest on invested capital. Each machine must, therefore, effect during its use such direct or indirect economies as may jointly exceed the expense of its upkeep. A desired implement may, for instance, cost 20*l*., and the annual charges against it amount to, say, 3*l*. 10*s*. ; the question is whether it can earn this amount, either by helping to save the crop in better condition or by expediting the harvest so that the regular labour may be the sooner available for other work, or by actually reducing the expense on labour. If the machine under consideration is

one whose function is already performed, though less perfectly, by another already possessed, the question becomes that of whether the special advantages are worth 3*l.* 10*s.* per annum.

Certain machines are applicable only under particular conditions and others are not of real service unless they form part of a complete set. The latter are most suitable for holdings large enough (250–300 acres) to employ a staff of six or seven hands and five horses, and, by way of paradox, save labour only when labour is available to operate them. The loader and the sweep-rake necessitate the use of contrivances that expedite stacking, and vice versa; and stacking machines are little suited for work at small stacks.

The chief consideration in favour of proper mechanical equipment is that it economises time and risk. The haymaking season is frequently a period during which the farmer has anxiety on account of the brevity of the opportunities for securing the crop in good condition. There were, for instance, seventeen rainy days in July and fifteen in August, 1918, to hinder haying operations on farms near Derby; and although most farmers would be glad to engage suitable extra hand labour to assist, particularly when making or leading is possible, in practice the regular workers have nowadays to secure the crop with little or no special manual help. The function of so-called labour-saving machinery is, therefore, to enable the regular staff of a farm to make the best of the favourable weather and to harvest hay that would otherwise be lost or damaged.

The following estimates are intended as rough indications of the relative quantities of hay secured in a given time under three different methods of handling:—

(*a*) Without machinery:

	Daily cost of labour and horses.					
		s.		£	*s.*	*d.*
2 men pitching from windrow	6 men	at 8		2	8	0
1 man loading	1 boy	,, 4		0	4	0
1 boy leading loads in and out	3 horses	,, 5		0	15	0
1 man unloading		Total		£3	7	0
2 men stacking						
3 horses and carts		Cost per ton		0	6	8

Unless the journey occupied nearly fifteen minutes each way, the boy would have a certain amount of spare time at either end, for the loading and unloading of a half-ton load take up about an hour. At this rate of working the gang will clear and stack about 1 ton per hour, or 10 tons (8 acres of average meadow) in a full day. When stacking in the field, two carts would suffice for the same.

(*b*) With hay loader and horse-fork or elevator :

1 man in charge of loader and chain horse
2 men loading
1 boy leading loads in and out
1 man unloading
1 boy driving the fork-horse
3 men on the stack
3 horses and waggons
2 other horses
With an elevator in place of the horse-fork, one boy or man less.

Daily cost of labour and horses.

		s.	£	*s.*	*d.*
7 men	at	8	2	16	0
2 boys	„	4	0	8	0
5 horses	„	5	1	5	0
Total			£4	9	0
Cost per ton			0	4	6

Loading and unloading each take up about fifteen minutes, and when the distance is convenient the gang can clear and stack 2 tons per hour or 20 tons (16 acres of average meadow) in a full day. Where the field is farther away from the stack a fourth waggon is necessary to maintain that pace.

(*c*) With two hay sweeps and an elevator :

2 men sweeping to the stack
2 men pitching into elevator
4 men stacking
4 horses sweeping
1 portable engine or 1 horse

Daily cost of labour and horses.

		s.	£	*s.*	*d.*
8 men	at	8	3	4	0
5 horses	„	5	1	5	0
Total			£4	9	0
Cost per ton			0	3	7

The gang will clear and stack about $2\frac{1}{2}$ tons per hour or 25 tons (20 acres of average meadow) in a full day. In this case, however, there is the further labour of leading home when the hay is required for use at the steading, and thatching may be an extra.

In dealing with small quantities, and if hand labour is available, the cost per ton of making may be less without machinery than with it. The case of the swath turner may serve to illustrate this. A man and a horse will turn with a swath turner 20 tons twice in two days ; the cost may be approximately estimated at 16*s.* for the man, 10*s.* for the horse, and 3*l.* 10*s.* as the annual charges against the machine ; the total is 4*l.* 16*s.* The same work might be performed by four men in two days at a total cost of, say 4*l.* But if the quantity of hay grown were 40 tons the whole costs would be 6*l.* 2*s.* and 8*l.* respectively. Likewise the cost per ton is less in loading and stacking relatively small quantities by hand than with the aid of machinery.

Estimates of costs of farm operations are always arbitrary and the prices obtaining at this date are unstable. The following figures are offered for what they are worth, having regard to the said circumstances ; but they may indicate how the farmer may make his own calculations for the purpose of

comparing the total cost of leading and stacking a ton of hay by the three methods before described.

The costs of hand and horse labour have already been estimated at 6*s.* 8*d.* per ton in (*a*), 4*s.* 6*d.* per ton in (*b*), and 3*s.* 7*d.* per ton in (*c*). The equipment necessary to the latter two methods would at present prices cost approximately the following amounts :—

(*b*)	£	*s.*	*d.*	(*c*)	£	*s.*	*d.*
1 hay loader . .	35	0	0	2 hay sweeps . .	60	0	0
3 hay holders . .	10	0	0	1 30 ft. elevator . .	90	0	0
1 horse fork . .	20	0	0	Horse gear for elevator	15	0	0
Total . .	£65	0	0	Total . .	£165	0	0

Interest, depreciation, and storage, would be fairly chargeable as under :—

(*b*)	£	*s.*	*d.*	(*c*)	£	*s.*	*d.*
Interest at 5 per cent. .	3	5	0	Interest at 5 per cent. .	8	5	0
Depreciation at 10 per cent.	6	10	0	Depreciation at 5 per cent.	8	5	0
Storage, oil, &c. . .	0	10	0	Storage, oil, &c. . .	0	15	0
Total . . .	£10	5	0	Total . . .	£17	5	0

Now the elevator and gearing are of service also for corn harvesting, and to a certain extent the sweeps are useful for that purpose. As regards the majority of farms, therefore, it will not be unfair to assume that the annual charges against the two sets of tackle are about equal.

The following table summarises the total costs per ton of leading and stacking various quantities of hay by each of the three methods before described :—

	(*a*) Without machinery	(*b*) With loader *and* unloader	(*c*) With sweeps and elevator
	s. *d.*	*s.* *d.*	*s.* *d.*
(1) 20 tons .	6 8	14 0	13 10
(2) 40 ,, .	6 8	9 7	8 8
(3) 60 ,, .	6 8	7 11	7 0
(4) 80 ,, .	6 8	7 1	6 2
(5) 100 ,, .	6 8	6 6	5 7
(6) 120 ,, .	6 8	6 1	5 3

It would appear that as regards direct economy machinery affords little or no advantage when the quantity of hay dealt with is less than about 100 tons, or 80 acres of average crop. But as already stated, the chief consideration is economy of time, and risk of weather injury. Moreover, hay is not the

only crop or subject demanding attention in July, and machinery may confer on the farmer a most valuable advantage in enabling him to keep farm operations generally well in hand. The above table may suggest certain quantities as being necessary to justify the purchase of particular implements, but as a broad proposition it may be stated that if the full regular staff of a farm are unable to keep well abreast with the season in a normal hay harvest, it will be economical to introduce such machinery as may enable them to do so.

County Offices, Derby. J. R. BOND.

THE DIFFICULTIES OF GROWING RED CLOVER—CLOVER SICKNESS, AND OTHER CAUSES OF FAILURE.

INTRODUCTION.

SINCE the time of its introduction to English agriculture by Sir Richard Weston in the seventeenth century, red clover has rightly occupied a prominent place amongst arable crops. Not only does it produce a large and valuable crop of fodder at relatively low cost, but it also contributes, perhaps more largely than any other one factor, to the maintenance of fertility of arable soils through the large quantities of nitrogen which this plant collects from the air, and which in due course are returned to the soil. In normal practice red clover is taken at varying intervals of time in the rotation from once in six to once in ten years, and it would generally be taken much more often but for the well-known fact that, when red clover is taken frequently on the same land, the crops are liable to fail, and the land is said to become clover sick.

The causes which may lead to the loss of a clover plant are very numerous, and though not all of these are included in the somewhat vague term clover sickness, yet it seems important at the outset to enumerate them, and so to clear the air.

The most frequent causes given for the failures to obtain clover crops are :—

(1) Failure to establish suitable conditions in the seed bed for germination and growth. This is very frequent, and in no way connected with clover sickness, though the death of the plant soon after germination is often ascribed to it. In seeding clover three conditions are necessary to ensure success. Firstly, the soil should be firm, so that the root, as soon as germination occurs, may have a firm moist earth to grow in; secondly, the seed is very small, and must not be buried too

deeply, or it may fail to germinate, and reach the surface; thirdly, the seed must be covered with a shallow layer of soil after seeding to protect the germinating plant from the drying of the sun and air. These conditions will, of course, be obtained by different methods in different classes of soil, and on different tilths.

(2) Lack of lime in the soil. All leguminous plants require a fair supply of lime for free growth. In soils which are sour or acid from lack of lime the plants grow feebly, and produce indifferent crops.

(3) Lack of inoculation. Clovers and other leguminous crops live symbiotically (in partnership) with bacteria in nodules on their roots, and do not grow satisfactorily without them. Under English conditions the nodule bacteria are rarely, if ever, absent from the soil, though in new countries this may be an important factor.

(4) Parasitic animals and insects. There are numerous insects which feed upon red clover, causing a greater or smaller amount of damage to the plant. Thus weevils frequently eat the leaves, so also do slugs and snails. Again, surface caterpillars often eat the clover plants between stem and root, and may occasion considerable damage to a thin plant of clover. But infinitely the most serious of the animal pests of clover is the clover eelworm (*Tylenchus devastatrix*). This minute insect is responsible for a large proportion of the failures of clover which are generally spoken of as clover sickness.

(5) Parasitic plants and fungi. Again, there are numerous parasitic plants which prey upon red clover, causing greater or less damage. The most obvious of these are clover dodder and broomrape. The former often owes its presence to impurity of seed, the ravages of the latter should be reduced by breaking up the clover plant after the first cut, since it is to the second cut that this parasite does the greater damage, and it is during the growth of the second cut that the majority of the broomrape flower-heads form and reseed the ground either directly, or after being made into hay.

The parasitic fungi are represented by clover mildew, which is often present on clover in autumn, and by leaf spot (*Pseudopeziza Trifolii*), but neither of these occasion the death, though they undoubtedly reduce the vigour, of the plant. One fungous disease, however, namely, clover stem-rot (*Sclerotinia Trifoliorum*) shares with the eelworm disease the responsibility for the majority of the cases of clover sickness which occur in England.

(6) The excretion of toxic or poisonous substances by the clover roots, which, remaining in the soil, cause the failure of subsequent clover crops if resown too quickly.

The purpose of this paper is to examine the relative importance of the clover eelworm disease, the clover stem-rot disease, and the production of toxic substances as causes of clover sickness.

The Eelworm Disease—Tylenchus Devastatrix.

Appearance of the Disease.

This disease has been well known to entomologists for many years. The Dutchman, Dr. J. Ritzema Bos,[1] made a

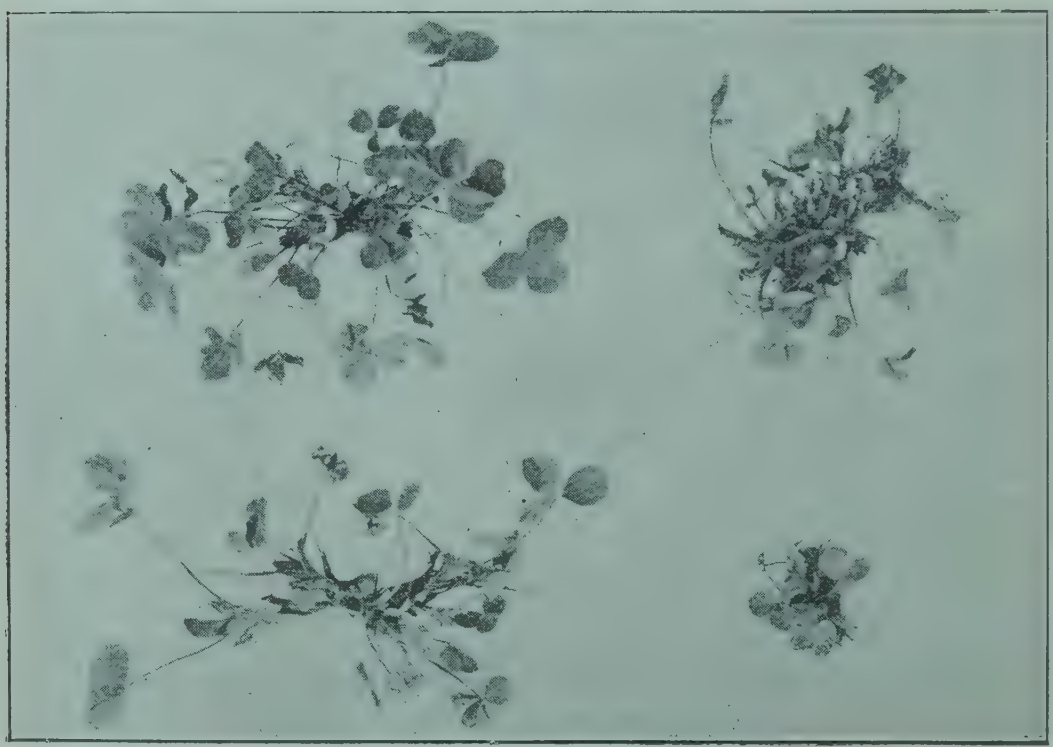


Fig. 1.—The eelworm disease of clover. Contrast the stunted habit of the diseased plants on the right with the healthy plants on the left.

very complete study of this and other eelworms, and Miss Ormerod[2] observed and studied the disease in England many years ago. But in spite of these researches and the description of the disease by Massee,[3] the eelworm disease has not been generally recognised as one of the primary causes of clover sickness by agriculturists.

The disease may attack clover plants at any stage, but is most quickly fatal to seedlings; nevertheless, it does not frequently do much damage to seedling clovers in the field because

[1] *Agricultural Zoology.* J. Ritzema Bos.

[2] *Manual of Injurious Insects.* E. A. Ormerod. *Report of Observations of Injurious Insects*, 1889 and 1890. E. A. Ormerod.

[3] *Diseases of Cultivated Plants.* G. Massee.

the dry conditions of spring and summer do not favour the spread of the disease. It can readily be observed in autumn on infected fields by the presence of small, more or less circular, patches in the clover, the plants on which appear to be stunted in growth ; if kept under observation during the year these diseased patches will be found gradually to extend



FIG. 2.—The eelworm disease of clover. Contrast the stunted habit of the diseased plant on the right with the healthy plant on the left.

in area. As the season advances the plants in the centre of the patches become gradually more and more stunted, turn from a healthy green to pale green, then brown, and finally die. Plants which are not attacked till late in the winter may not be killed ; they may produce a small first cut, but little or no second cut of hay.

Careful observation of the diseased and stunted plants will show the following characteristics, illustrated in Figs. 1 and

2 :—The stems are short, stunted and swollen ; numerous side shoots are formed, but they never develop into stems, and remain stunted also : the old leaves gradually die ; the new leaves are distorted ; the petioles or stalks of the new leaves are very short and are often brown and decayed at places ; the leaf blades are small and distorted and the veins on the underside are also brown and decayed ; the stipules to the leaves also become brown and decayed ; the roots are at first uninjured, but, as the leaf area of the plant is gradually reduced, these too lose vigour and eventually die and decay when all the foliage has been killed, though the roots are not directly attacked by the eelworms.

The eelworms are not easily seen with the naked eye, but if the diseased parts of the leaves and stipules (especially in the early stage of attack and before the parts have decayed) are teazed or rubbed out in a small quantity of clear water, the eelworms may be seen as minute wriggling creatures when the glass is held to the light. Under the microscope the eelworms can be easily seen ; they live in immense numbers in the diseased parts of the stem and leaves on which they feed ; they vary greatly in size according to age ; when full-grown their bodies are often crowded with eggs ; these eggs are eventually liberated into the tissues of the plant or into the soil. The eggs may hatch out quickly or, if dried or buried in the ground, may lie dormant for a long time, and by this means serve to keep the disease alive in an infected field for several years.

In my opinion this eelworm disease is responsible for the greater number of clover failures ascribed to clover sickness in the eastern counties, and in parts of Norfolk, Cambridge, and Hertfordshire it is particularly prevalent ; moreover, it is responsible for perhaps the most serious form of sickness, for a plant once attacked by the eelworm does not recover, and the only procedure to adopt in the case of a field in which the disease is widely distributed is to plough up the land and plant another crop.

Propagation and Persistence of the Disease.

As previously described the mature eelworms produce large numbers of eggs which, if they hatch out under suitable moist conditions, wriggle about on the soil and so transport themselves to and infect a neighbouring plant. Doubtless the disease may also be transported mechanically by birds and animals feeding on diseased plants and by implements used in cultivating diseased soil.

It is particularly interesting to consider how the disease may persist from one clover crop to the next. The following

history of a field in the occupation of Mr. Tom Coleman, of Beauchamps, Buntingford, illustrates how tenaciously the disease clings to a field in which it is once established.

In 1908 a 12-acre field was carrying a clover plant, from which the clover failed on two acres only.

1909, wheat.

1910, oats.

1911, bare fallow.

1912, wheat.

1913, single-cut clover (cow grass). All the plant was good till the end of autumn, but went off badly in February, when it was ploughed and sown with cluster beans.

1914, wheat.

1915, barley.

1916, Italian rye-grass and clover was grown again under the mistaken idea that as no crop of clover was taken in 1913, very little toxic or poisonous material could have been left in the soil.

In March, 1916, the field was inspected, when the clover over all the field was found to be diseased, scarcely a single plant being found which was not attacked by the eelworm. Doubtless eelworms were the cause of failure in 1908 and 1913; in each year myriads of eelworm eggs were left in the soil and infected the 1916 crop. The fact that the 1913 crop was ploughed early and not cut for hay would not prevent the eelworms from producing their eggs during the winter 1912-1913.

Isolated spots, in which the eelworm disease is present, occur on the University Teaching Farm at Cambridge. In 1914 such a spot in a field of clover was noted. It so happened that the second crop was folded, and in the neighbourhood of this diseased spot the clover set seed before being eaten; the land was consequently self-sown. In 1915 the field was cropped with oats, but as the stubble was broken up immediately after harvest no observations on self-sown clover could be made that year. In 1916 it was cropped with wheat; numerous self-sown clover plants came up and grew amongst the stubble in autumn, and many of these were diseased with eelworm. In 1917 mangolds were grown, but in spite of horse and hand hoeing a few self-sown clover plants survived till the crop was harvested, and three of these were found to be attacked and destroyed by eelworm. In 1918 trefoil and rye-grass were sown amongst an oat crop on this field, and again after diligent search three diseased self-sown red clover plants growing in a group were found in March, 1919. The presence of these diseased self-sown plants on the field two and three years after the main clover crop had failed illustrate one of

the means whereby the disease is enabled to carry on from one clover crop to the next.

Other Plants Attacked by the Eelworm Disease.

It is generally held that this eelworm (*Tylenchus devastatrix*) attacks many other plants besides red clover. Thus, in his book on Agricultural Zoology, Dr. Bos says :—"The eelworm is parasitic on rye, oats, onions, hyacinths, clover, buckwheat, pinks, and on wild plants, such as annual poa grass, and sweet vernal grass."

Dr. Bos further states :—"It must also be added that eelworms, of which the progenitors have developed for a considerable number of generations in the same plant, are not easily transferred to another kind of plant, or at any rate do not multiply vigorously there." This statement I have tested repeatedly (more than twelve times) in respect of the possibility of the clover eelworm attacking oats. The experiments have been carried out under a great variety of conditions, using eelworm infected soil from several localities, and upon both winter and spring varieties of oats. It is satisfactory to record that in no case have I been able to infect oats with clover eelworm. Further, the results of these tests have been supported by many observations and inquiries in the Eastern Counties on farms where the eelworm disease of clover is prevalent. In no case have I been able to find the oats, on land suffering from eelworm in clover, infected with the disease, although the farmer has in some cases mistaken attacks of frit fly for the eelworm disease. On the other hand, Miss Ormerod records one or two instances in Scotland in which eelworm attacked both clover and oats on the same field.

There is, fortunately, no reason to believe that this eelworm can attack wheat or barley, or root crops, but the same cannot be said for the leguminous crops, some of which are certainly and readily attacked by the eelworm, though others are fortunately quite immune. In order to test the degree of immunity of the various leguminous crops in common cultivation in England, seed of these has been sown in soil infected with clover eelworm both in the field and in boxes, the plants being kept under careful observation. The following notes explain the results of several trials.

Common red clover is always very badly attacked, whether the seed is home grown, or originates from France, the United States of America, or Chile.

Late-flowering red clover (single-cut cow grass) is generally severely attacked, and frequently killed. But it is certainly much more resistant to the disease than the annual variety.

Thus in June, 1918, a number of varieties of red clover were sown in rows side by side on infected land. In December, 1918, all the strains of common red clover were badly diseased, and almost or quite dead ; the row of cowgrass was still a full plant, but careful examination showed that the majority of the plants are now diseased, by the end of January the disease had attacked all the plants, but in March the plants, though badly diseased, were holding their own.

Wild red clover. Seeds of the wild plant were collected from old pasture, and used for the experiment. These plants are not perfectly immune ; for instance, seeds sown late in August, 1917, germinated in September, and as seedlings were badly attacked during the autumn and winter of 1917—18, and many, but not all, were killed. On the other hand, seed sown in June, 1918, has grown well this autumn, and at the present time appears to be healthy, though surrounded by dying annual red clover plants. Closer examination, however, shows that some of the plants are slightly diseased.

Alsike or Swedish clover is badly attacked by the disease, not perhaps so badly as the annual red clover, but it is nearly, if not quite, as susceptible as cowgrass.

Kidney vetch again is very susceptible to the disease.

Crimson clover is somewhat susceptible, but less than any of the foregoing, except the wild red clover.

White clover (Dutch variety) is but slightly susceptible. I have found several diseased plants when growing under experimental conditions side by side with badly diseased red clover plants, in which case it may be presumed that the eelworms would be very abundant ; and I have seen on one occasion a diseased white clover plant growing, by chance, on a patch of diseased red clover. On the other hand, I have on many occasions seen healthy white clover plants growing freely amongst similar diseased red clover plants. I have never found white clover, sown pure, attacked by this disease.

Trefoil (*Medicago lupulina*). This plant is for all practical purposes immune. I have seen it growing quite healthily on many occasions in a mixture with red clover, alsike, and kidney vetch, all of which were badly diseased. I have never seen it attacked in the field, but on one occasion, in an experimental plot by the side of diseased red clover, when the trefoil had become rather overgrown, and the stems were falling on the ground and beginning to decay, I found eelworm in the upper leaves. It is quite conceivable that in this case the eelworm were enabled to gain access saprophytically to the foliage beginning to decay, and were not in this case parasitic. It is my opinion that trefoil may be grown with perfect safety under field conditions on land infested with eelworm.

Lucerne. In the general case lucerne is not attacked by the clover eelworm, but I have seen eelworms attacking plants under experimental conditions under similar conditions to those described in the case of trefoil. It may be confidently stated that this plant is not attacked under field conditions when growing by itself as a crop.

Sainfoin. I have frequently put this plant to the most severe tests to determine whether under any circumstances it can be attacked by eelworm, but I have found no instance when this has occurred. Sainfoin may, therefore, be regarded as perfectly immune. The botanical explanation of this immunity is probably that in this plant the stipules, which in red clover are generally the first part of the plant to be attacked, are thin and somewhat leathery, or like parchment, and in no sense are they succulent, a condition of texture in which the eelworm revels.

Peas, beans, and vetches are not commonly attacked by the disease, but Miss Ormerod has described the attack of this disease on beans.

Italian rye-grass is not attacked.

Remedial Measures.

The foregoing discussion upon the susceptibility and immunity of various leguminous crops points the way to the most successful method of eliminating and preventing clover sickness when it is occasioned by the stem eelworm ; but it is important that both farmers and teachers should be able to identify the disease with ease and accuracy before applying the remedy. The obvious remedy consists in avoiding red clover and all susceptible species for a long period (eight to ten years), so that the eggs of the eelworm may have time to hatch and perish for want of a suitable host plant before any crop of red clover is planted. In place of this crop, sainfoin, lucerne, trefoil or white clover grown alone or mixed with Italian rye-grass can be substituted.

Dr. Bos and other writers have shown that the disease may be reduced by manuring the land with sulphate of potash.

Another common recommendation in cases of clover sickness which has received wide application, and continues to receive commendation,[1] is to substitute a mixture of seeds containing alsike, kidney vetch, trefoil and Italian rye-grass for red clover and occasionally even to include a few red clover seeds in the mixture. If the cause of clover sickness is eelworm, no policy could be more fatal, since alsike and

[1] *Journal of Board of Agriculture*, December, 1918. "Notes on Manuring." *Food Production Leaflet*, *No.* 61. Seed mixtures for land affected by clover sickness.

kidney vetch, to say nothing of the red clover itself, are all susceptible to this disease, and therefore the inclusion of these plants in the mixture serves to provide a host plant for the multiplication of the eelworm and thus to perpetuate the disease in the field. Such recommendations, without reference to the particular form of clover sickness, ought not now to be made.

The Stem-Rot of Clover—Sclerotinia Trifoliorum.

This fungus disease of clover has often been described both in earlier numbers of this Journal[1] and elsewhere; it is generally, though I think erroneously, supposed to be the most serious cause of clover sickness. It makes its first appearance upon the young clover plant during the early winter months (I have recorded the first appearance of the disease twice in November and once in December during the last three years). At this stage the disease attacks the foliage, stem and leaf only, which are first partially covered by a white spawn, mycelium; this rapidly causes the foliage to turn brown and rot, hence the name stem-rot disease. In some cases all the stems on a plant as well as stems on neighbouring plants are attacked almost simultaneously and rot down together; in other cases (see Fig. 3) one or more stems on a diseased plant may escape attack and continue to grow and thrive after other stems have rotted off. The spread of this spawn or mycelium is especially rapid during damp, misty and foggy weather, and under these conditions the mycelium can be seen spreading over the ground for an inch or more from the diseased stem in search of other clover stems growing near by. When the damp, misty weather gives place to dry or frosty weather then the spread of the disease is delayed.

Although, as described above, the disease may spread at a great pace over the foliage and cause the diseased stems to rot rapidly, it does not attack or destroy the roots so quickly. If the roots of a plant from which all the shoots have rotted be dug up and examined, they may be perfectly sound and healthy for weeks after the attack; then gradually, if the disease keeps the upper hand, the disease attacks the root and kills this also; in other cases new buds form on the crown of the root, which under favourable conditions grow normally and produce healthy stems and flowers. Frequently I have seen clover fields, which have lost a half or two-thirds of their plant during the winter by the action of the stem-rot disease, revive in the spring and produce a moderate crop of clover. In

[1] "Clover Sickness and Its Cause." By Gussow, H. T., 1903.

cases of revival it often happens that occasional stems wilt during the summer owing to renewed activity of the disease.

If, however, the whole plant, root as well as foliage, is killed by the disease, then later in the year small leathery excrescences, called sclerotia, are formed on the roots during the spring and also on the stems at an earlier date. These sclerotia, which are first white, eventually turn grey and then black ; they are often said to resemble mouse dung and have a texture rather similar to that of unripe cheese ; they play an important part in the life history of the disease, since it is these sclerotia which lie dormant during summer and so



FIG. 3.—Clover attacked by "stem-rot" (*Sclerotinia Trifoliorum*), showing one healthy stem and the remainder killed by the disease.

provide for the revival of the disease the following or subsequent autumns. The sclerotia are mainly situated at or close to the surface, but may be as deep as 4 inches below the surface.

The sclerotia may remain dormant in the soil for a number of years until conditions are favourable for them to recommence growth ; such growth seems to be associated with the advent of moist, cool weather in autumn after the drier hotter conditions of the soil in summer. Growth is manifested by the appearance of minute flesh-coloured toadstools or apothecia which

develop from the sclerotia and remain attached to them by stalks (see Fig. 4). The actual dates, upon which I have first found these apothecia during the last four years, have been October 30, 1915, October 6, 1916, October 20, 1917, and October 11, 1918. Generally the apothecia have been abundant on the old clover layer (if diseased) till the middle of November. I have once also noticed a recently grown apothecia in May, namely May 3, 1916. If a badly-diseased clover ley has been left unploughed till this date, one may sometimes find as many as ten or fifteen such toadstools growing out of the sclerotia attached to the dead roots and stems of a clover plant which has been killed by this fungus during the previous winter. The final link in the life history of this disease is the production of very numerous spores or seeds on these toadstools which are shot into the air, and if these spores chance to

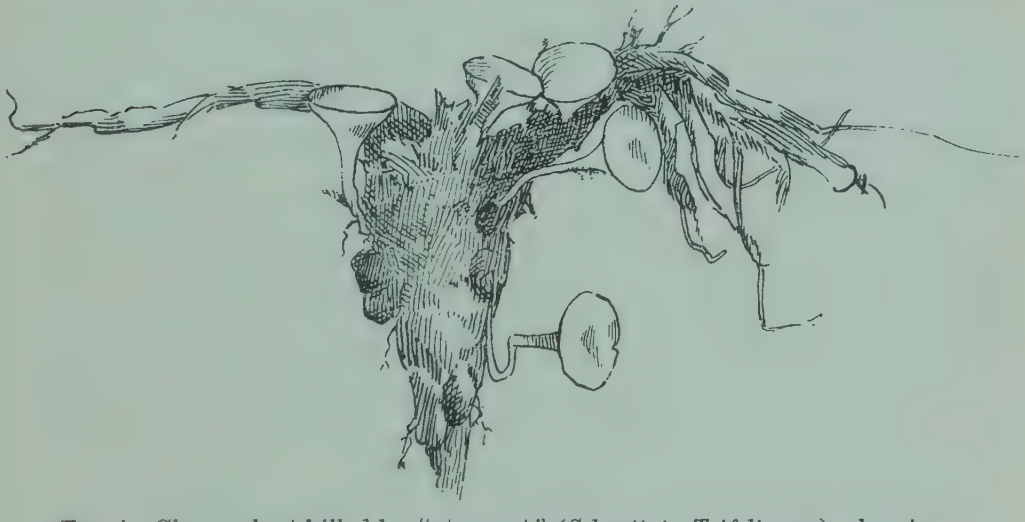


FIG. 4.—Clover plant killed by "stem-rot" (*Sclerotinia Trifoliorum*), showing sclerotia embedded in root of clover and apothecia growing out of the sclerotia.

fall upon clover plants then they may grow and infect the clover plants and reproduce the characteristic rotting of the foliage associated with the stem-rot disease. If the clover ley has been ploughed early and the sclerotia buried by the ploughing, or if the surface soil is disturbed, then the sclerotia do not generally germinate that autumn, but may do so at some future season when conditions are favourable.

In the past there has been a considerable amount of confusion between this stem-rot disease and the eelworm disease, thus, in a report upon varieties of red clover, published by the Agricultural Department of Leeds University,[1] it is stated :—"The cause of this crown rot is generally said to be a

[1] "Report on Nationalities and Varieties of Red Clover." No. 57, Agricultural Department, University of Leeds, page 17.

fungus (*Sclerotinia*), but some authors put it down to minute eelworms. A number of diseased plants of red clover from different localities have been examined at Garforth, and, in every case, both the fungus and the eelworms were present in the rotting crowns." This is no isolated instance of the confusion which exists. The writer has met many agriculturists who do not know how to distinguish the two diseases. Often the confusion such as that quoted above, "that both the fungus and the eelworms were present in every case," is probably due to the inability to distinguish between the parasitic clover eelworm and the various forms of free-living eelworm which are always present in decaying vegetable matter ; and since the precautions to adopt in fighting clover sickness must depend upon the nature of the disease, the following points of contrast in the appearance of the diseases are inserted to enable the distinction to be easily made.

The eelworm disease generally starts from a central point or points (unless the field is very badly infected), and spreads slowly and surely in an ever-widening circle. Parts of the field where the disease is not present may remain healthy, whilst in the diseased areas all the plants are more or less severely diseased. A plant once attacked dies slowly. It becomes stunted, the stems present a swollen appearance, and the whole plant gradually turns from green to brown.

The stem-rot disease is generally distributed more or less regularly over all the diseased fields, though parts of the fields may be attacked much more severely than others. Under favourable conditions the disease spreads rapidly, stems after being attacked rot down in a few days (the spread of this disease may be likened to the spread of potato disease in moist weather). If a period of dry weather, and sometimes frosty weather intervenes, then the progress of the disease is checked. Some diseased plants will often be found with one or more quite healthy shoots ; other plants, the foliage of which has been killed by the disease, may form new buds, which eventually grow into healthy stems and produce a crop of clover, or, on the contrary, these stems may suddenly wilt at any time before the hay crop if the disease happens to revive and continue its attack on the plant.

Other Plants Attacked by Stem-rot.

Just as the eelworm disease attacks many other plants besides red clover so does the stem-rot disease, and it is important to know which plants are susceptible and which immune.

Under laboratory conditions (*i.e.*, conditions under which every chance is given to the stem-rot to grow), all leguminous

crops that have been tested, *e.g.*, perennial red clover (cow grass), alsike, sainfoin, lucerne, trefoil, white clover, beans, peas, and tares, readily take the disease, but it does not follow that these plants necessarily take the disease in the field, consequently during the last seven years a careful watch has been kept upon such growing crops on many farms, and the following observations have been made.

Late-flowering red clover (single-cut cow grass) takes the stem-rot readily, but not so readily as does the common red clover.

Alsike when growing in a mixture of seeds has been observed to be diseased on several occasions, but in no case very severely.

Sainfoin, which is immune to the eelworm disease, is by no means immune to stem-rot. Frequent cases of this disease have been noticed during the first autumn of its growth, and occasionally this crop is severely attacked. Generally speaking, however, it is much less susceptible than red clover, and this comparative immunity may be associated with the different character of the autumn foliage. Sainfoin rarely, if ever, produces such a thick matted growth as red clover in mild autumns.

Lucerne is frequently attacked and destroyed by this disease during the first winter of its growth, but those plants which stand the first winter are rarely attacked in the succeeding years. The older plants seem to be more resistant. These observations agree with those of Gilbert and Myer[1] in Kentucky.

Trefoil is not often seriously damaged by "stem-rot" in the field, but in exceptional cases, and especially when a luxurious matted growth of foliage has been produced in autumn, the disease may run through the field and cut down the greater part of the foliage. If this happens, as in the case of red clover, a second shoot may be produced and a useful crop realised if weather conditions are subsequently favourable.

Occasional plants of Dutch white clover may be attacked by "stem-rot," but I have never seen serious damage occasioned.

Beans in some cases take the disease badly, and may be killed by it both in winter, spring, and early summer. This fact has not been generally recognised in the past, although, in some heavy land districts of Cambridgeshire and elsewhere, it is well known that clover sown amongst wheat on a bean-tilth is very liable to stem-rot, and is, therefore, rightly held to be bad practice.

In order to establish the susceptibility of beans to stem-rot it may be well here to insert a few observations that have

[1] "Stem-rot of Clovers and Alfalfa as a Cause of 'Clover Sickness.'" Kentucky Agricultural Experiment Station, 1915.

been made :—In April, 1914, on Mr. J. Frohock's farm at Lolworth, Cambs., a 20-acre field of clover, which had been planted in 1913 amongst wheat, was divided by a straight line across the field into two parts ; the part on the west side of the field was badly diseased and 50 per cent. of the plants killed by "stem-rot," the part to the east carried a useful crop with perhaps 5 per cent. of diseased plants. The field had been treated in every respect the same and was normally farmed as one field, except that in 1912 the west side of the field carried a crop of winter-sown beans and the east side a crop of spring-sown peas.

A second observation was made on a field at Ware, in Herts., farmed by Mr. Vigus ; this field was so badly infested with wild onions that all white straw corn crops grown upon it were practically unsaleable. Mr. Vigus conceived the idea of trying to grow beans upon the land almost continuously, so that he could the more readily clean the land and destroy the onions as they germinated in successive years ; accordingly the land was cropped in the following order :—

1912, beans.
1913, wheat.
1914, beans.
1915, beans.

On June 1, 1915, I was asked to examine the crop, which was failing in places ; many of the beans had long since died and others were wilting. These beans had been killed by the clover stem-rot disease, and numerous sclerotia were found on the roots of the dead beans. It is interesting to note in this case that the disease was not uniformly distributed in the field, but varied with the manuring of different parts. On one part no manure had been given, here the disease was very bad ; on a second part about twelve loads of dung had been put, here the disease was moderately bad ; and on a third part about 5 cwt. of basic slag had been put, here the disease was not prominent and but few of the bean plants were affected.

The third observation was made at the experimental farm at Saxmundham, in Suffolk. When the farm was first taken for experiment it was laid out on the four-course rotation with red clover once in four years. This rotation had soon to be discarded because the red clover failed with clover sickness ; then it was decided to substitute beans for red clover, and generally the bean crop has succeeded, but the bean crop on one field sown in the autumn of 1915 lost so many plants during the winter that it was intercropped with peas in the spring. The peas grew well, but the beans continued to die during spring and summer. I saw the field in June, 1916, when the remaining beans were very thin ; the dead plants

had obviously been killed by the clover "stem-rot," and sclerotia were numerous on the dead roots.

Fig. 5 illustrates another observation. A number of beans were planted in a flower pot, and after germination, apothecia, or the "toadstools" of the disease, were planted amongst the bean plants. The photograph illustrates the death of the beans caused by the stem-rot.

It may be a surprise to some that stem-rot on beans is not more commonly noticed in the field. Probably the reason for



FIG. 5.—Bean plants in the process of being killed by "stem-rot" of clover.

this is that when a bean plant is diseased in winter it rots down very quickly to an inconspicuous black mass, and since beans are sown in wide rows and the plants do not become intertwined, the chances of spreading from plant to plant are very much smaller than in the case of clover; and it is to be remembered that this fungus produces no summer spores, hence the spread of the disease must be occasioned by contact with the mycelium or spawn growing out from diseased plants.

Neither peas nor tares have ever been noticed to be infected with the disease in the field, though they may be made to contract it in the laboratory. The observations recorded above on Mr. Frohock's farm, and at the Saxmundham experiment farm, support the conclusion that peas rarely if ever take the

disease in the field. Moreover, the facts that the greater part of the resting fruits of the disease (the sclerotia) germinate and produce and scatter their spores in October or November, whereas the pea crop is generally not sown until March, helps to prevent the possibility of infection.

Remedial Measures.

As in the case of the eelworm disease, the most obvious remedy for the stem-rot of clover is to avoid growing red clover, common or cow grass, frequently on the same field, by this means providing for the growing out and destruction of the resting form of the disease in the interval when no clover plant is present on the land. The precaution is particularly necessary if the previous crop has been attacked and the field badly infected with the resting form of the disease. On soil which is naturally healthy for clover, and on which the disease is not prevalent, red clover may be taken as often as once in five or six years, especially if the clover is sown as a mixture with grasses and other leguminous plants, but on most soils, and especially if the disease is known to have been present in a previous crop of clover on the field, it will be necessary to allow an interval of eight, ten, or even twelve years ; during this period other less susceptible leguminous crops, *e.g.*, trefoil, white clover, sainfoin, may be grown, or such crops as peas, tares, or even beans, provided the latter crop is not grown shortly before the next clover crop.

Manuring. There is little doubt but that the stem-rot disease may be discouraged or encouraged by suitable manuring or the reverse. The subject needs further research, but an adequate supply of mineral plant food (lime, potash, and phosphates) are probably associated with healthy growth, whereas the growth of red clover on rich land abundantly supplied with organic and nitrogenous plant food may result in too luxuriant autumn growth which more readily falls a prey to the stem-rot disease.

In cases where luxuriant autumn growth is produced upon rich land, it is often good practice to feed off the clover to sheep during September and October ; this practice reduces contact between the leaves of neighbouring plants, so that the disease has less chance of spreading. On poor thin land such practice will probably reduce the crop, but upon rich land, known to be subject to the disease, considerable benefits may result.

The Excretion of Toxic Substances by the Clover Plant as a cause of Clover Sickness.

The idea that clover sickness may be due to some toxic matter excreted by the normal growth of a previous crop of

clover was the earliest explanation of clover sickness, thus Young,[1] writing in 1809, says :—"The unfortunate circumstance which attends clover, is its being extremely apt to fail in districts where it has been long a common article of cultivation. The land, to use a farmer's term, becomes sick of it."

This idea has been tenaciously held by farmers and others to the present time and it is often stated that the researches of Lawes and Gilbert supported this conclusion, possibly because as an introduction to two of their papers[2] they have stated that "the injurious influences arising from the matter excreted by the roots of a former crop, or from the decay of the roots themselves" have been assigned by others (not Lawes and Gilbert) as a cause of clover sickness, for Gilbert states in the second paper, "the results obtained on the garden soil seem to show that what is called 'Clover Sickness' *cannot* be due to the injurious influence of excreted matters upon the immediately succeeding crop." The above quotation was made in relation to a small experimental plot of clover, which was grown continuously for many years in the kitchen garden of Sir John Lawes and produced a crop equivalent to 26½ tons of hay per acre during the first six years of the experiment without being resown. The first crop was sown in 1854, the plot was resown in 1860, 1865, 1868, and 1870, and Gilbert, writing in 1871, says :—"At the present time not only is there no indication of failure, but, on the contrary, very luxuriant growth." In view of these facts I cordially agree with the above quotation that clover sickness cannot be due to the injurious influence of excreted matters from previous clover crops, for, if so, why did this cause not operate during the seventeen years between 1854 and 1871 on the garden plot?

It is true that in still later years the clover on this garden plot failed frequently, but examination of the plot in the years of failure showed the presence in immense numbers of the sclerotia or fruits of the stem-rot disease of clover, which were doubtless the cause of the failure in these later years.

Lawes and Gilbert in their papers on clover-sickness never admitted that disease could have been the primary cause of failure, yet I am inclined to believe that a close reading of their careful experiments and accurate observations, and especially a study of their chart[3] illustrating the distribution of the sickness in their experimental plots in 1852, will leave the

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[1] *The Farmers' Calendar*, by Arthur Young. 1809, page 123.

[2] Lawes & Gilbert: "Report of Experiments on Red Clover by Different Manures," Journ. R.A.S.E., 1860. Gilbert, J. H.: "Notes on Clover Sickness," *Journ. Roy. Hort. Soc.*, 1871.

[3] "The Growth of Red Clover by Different Manures." Journ. R.A.S.E., 1860.

impression on the reader's mind that disease of some kind was responsible for the failure; moreover, the concluding paragraph in both their papers—"the only means of insuring a good crop of red clover is to allow some years to elapse before repeating the crop upon the same land"—is a recommendation which provides the best prevention for any disease, the resting forms of which lie dormant in the soil; the resting forms of both eelworm and stem-rot have this characteristic.

It was doubtless because Lawes and Gilbert did not examine, except in a very cursory manner, the possibility of disease being the determining factor in clover sickness that they were unable to assign a definite explanation of this phenomenon.

Again, Sir A. D. Hall in discussing the manurial experiments on clover sickness on the Hoos field at Rothamsted, whilst admitting that *Sclerotinia Trifoliorum* is in many cases the direct cause of the death of clover plants, yet inclines to the belief that *Sclerotinia Trifoliorum* is not the determining cause, basing his belief on the fact that certain of the grass plots in the park at Rothamsted to which mineral manures including potash have been applied each year carry a very high percentage of leguminous plants, and that on grass paths separating the "clover-sick" plots on the Hoos field both white and red clover grow abundantly. In this connection it is to be remarked that, firstly, the white clover and the red clover found on grass land is generally not the same variety in either case as that grown on arable land; in both cases the wild forms are much more hardy plants, white clover is almost immune to both eelworm and the stem-rot disease, whilst wild red clover is certainly resistant to eelworm, though it has not yet been rigidly tested with *Sclerotinia*.

One other case relating to this subject is worth recording, since it bears directly upon the problem of whether the stem-rot disease can be a primary cause of clover sickness. A field on my father's farm at Wye, in Kent, was planted with clover in 1911; this field was cropped continuously with hops from 1890 to 1907, mangolds were taken in 1908, cabbage in 1909, mangolds in 1910, and wheat in 1911; the interval, therefore, between the 1911-12 crop of red clover and any previous crop must have been not less than twenty-two years; nevertheless, though the clover crop grew perfectly during the autumn of 1911, producing a matted carpet of clover, the crop died out badly in January under a severe attack of the stem-rot disease. In this case no question of the presence of toxic substances left in the soil from a previous crop of clover can be entertained, for no clover was grown on the field for twenty-two years. The stem-rot disease was the primary cause, and its rapid spread was due to the succulent and matted

condition of the clover foliage produced by the high state of fertility of the ground after the heavy manuring which hop gardens receive.

This case, in conjunction with the continuous plot of clover in the garden at Rothamsted and our knowledge of the eelworm disease, seems to prove that diseases and not the mysterious toxic substances are in the main responsible for the failures of clover generally called "clover sickness." Yet it may be freely admitted that other factors, *e.g.*, excessive amounts of nitrogenous plant food, insufficient mineral plant food, and weather conditions, &c., may materially influence the spread of the diseases.

Summary.

Failures of red clover crops may be due to a variety of causes, but the failures of the plants during autumn, winter, and spring, generally called "clover sickness," are usually due to one of two diseases, either eelworm disease or the stem-rot disease of clover.

These two diseases have been badly confused in the past. The eelworm disease is a disease which spreads slowly but very surely over a crop of clover; the stem-rot disease spreads rapidly during damp misty weather, and causes the stems and leaves to rot very rapidly, but on the other hand the spread of the disease is stayed in dry or frosty weather and the attacked plants may recover.

The eelworm disease attacks many of the leguminous fodder crops, but not all; sainfoin is quite immune; lucerne, trefoil, and white clover are for all practical purposes immune; so, too, are beans, peas, and tares. Kidney vetch, alsike, and wild red clover are somewhat susceptible; alsike and cow grass very susceptible, but not so badly as the ordinary red clover.

The remedy for the eelworm disease is to avoid all susceptible crops for a period of at least eight years; the practice of growing a mixture of susceptible and immune plants, comprising Italian rye-grass, alsike, trefoil, kidney vetch, and some red clover, which is so frequently recommended for all clover-sick land, is unwise when the disease is eelworm.

The stem-rot disease (*Sclerotinia*) has been made to attack all leguminous plants which have been tested by inoculation with varying degrees of severity; under field conditions, however, some plants are rarely attacked. No cases of stem-rot have been observed on peas or vetches, but winter beans are occasionally badly attacked. White clover never suffers serious damage; trefoil rarely. Alsike and sainfoin sometimes take the disease badly; cow grass is less susceptible than ordinary clover.

Prevention is better than cure in the case of this disease; don't grow red clover too frequently, especially if occasional diseased plants are found in the clover. Mixtures containing grasses and other leguminous crops with red clover hinder the spread of the disease; substitution of white clover, trefoil, and sainfoin for red clover tends to reduce the disease. Don't grow red clover within two years of beans. On highly farmed land, grazing with sheep in early autumn helps to limit the spread of this disease.

The evidence in support of toxic substances being excreted by a previous clover crop and causing clover sickness is very scanty, and it seems probable that such substances do not exist.

In conclusion, I wish to record the fact that most of the observations recorded in this paper have been made on the University Farm at Cambridge, often in awkward and unsightly situations. My thanks are due to Mr. Mackenzie and to Mr. Burgess, the farm manager, who have given me much advice and assistance, and to many farmers in the eastern counties for the history of numerous cases of clover sickness on their farms.

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TITHES, CORN RENTS, AND TITHE RENTCHARGE.

I.—HISTORICAL.

Classes of Tithes in Kind and the Methods of Payment.—According to the definition given in Wood's Institute (Ed. 1772), Book II., Chapter II., tithes were "the tenth part of the increase yearly arising and renewing from the profits on lands, stocks upon lands, and by the industry of the parishioners, payable for the maintenance of the parish priest, by everyone who has things titheable, if he cannot show a special exemption."

Tithes were usually divided into three classes, namely, predial, mixed and personal. Predial tithes were such as arose immediately from the soil, as corn, hay, wood, and all sorts of fruits and herbs. Mixed tithes were such as did not proceed immediately from the ground, but were produced immediately by animals depastured or kept upon the ground, as colts, calves, wool, lambs, milk and eggs. Personal tithes were such as arose wholly from the labour of man, as tithes of the labour and industry of millers and fishermen. The tenth of the actual produce was due in respect of predial and mixed tithes, but in the case of personal tithes only the tenth part of the actual gains

was payable. Tithes were due at different times, and to be rendered in different manner, according to their nature ; but the custom of parishes or districts had to be observed if such custom was not unreasonable. Predial tithes became payable immediately upon their severance from the ground, tree or plant ; tithes of animals, when they were fit to be weand ; wool when the sheep were sheared, and eggs, honey, and wax when they were taken.

By the Statute of 2 & 3 Edw. VI., c. 13, after severance, and at that stage of the process at which the tithe-owner could best judge whether he had his fair and just tenth part, all predial tithes had to be set out, that is, separated from the other nine parts on the land where the crop grew. The titheowner had a right within a reasonable time to see them so set out before the crop was removed from the ground, but he could not tithe the crop himself. Generally speaking, the tithe payer was under no obligation to guard the tithes or to send them to the titheowner, and it rested with the titheowner to arrange to fetch them from the land on which they were set out.

Where there was no particular custom to the contrary, the tithe of milk was held to be the whole of the milk every tenth morning and evening, in fact, all the milk yielded every tenth day, unless the first milking commenced in the evening, when the tithe would be the whole of that which was milked on the tenth evening and the next morning. The parishioner had to milk the cows into his own pails at the usual place of milking them, and the parson had to fetch the milk away in his own pails in a reasonable time. If he did not fetch it away before the parishioner had occasion for his pails or vessels for the next milking time, the parishioner was apparently justified in pouring the milk upon the ground (see *Dodson* v. *Oliver*, E. 1720, Bunb., 160, 2 Wood, 143, and *Baker* v. *Mason*, E. 1784, 4 Wood, 257). Where the cows were fed in one parish and milked in another, the tithe of their milk had to be paid to the parson of the parish in which they were milked, if the residence of the owner of the cows was there and they were not fraudulently removed.

Inconveniences of Tithes in Kind.—It will be readily understood that tithes were found to be a very unsatisfactory source of income. They were fluctuating, uncertain, and precarious, depending upon the manner in which the ground was cultivated and the will of the owner or occupier of the land over whom the titheowner had no control as to the manner of cultivation. The ground might lie fallow, or, where all the tithes were not vested in the same person, as in the common case of a lay impropriator and vicar, the titheowner's rights might be varied by

a change in the titheable produce of the land, either in the ordinary course of husbandry, or by the conversion of arable or meadow into pasture. Again, the land might lie waste and uncultivated, or it might be built upon, or converted into a park or warren, or in various other ways rendered incapable of producing any titheable matters whatever. The remedies, too, for the enforcement of the payment of tithes were not very effective in many cases. Furthermore, the whole system entailed a great deal of trouble to all concerned and gave rise to friction, which, in the case of clerical tithes, tended to diminish the influence and prestige of the clerical titheowner among his parishioners. According to one learned writer, in the year 1837, the expenses of the collection of tithes were then acknowledged to be not less than 25 per cent. of the value of the tithes and in some cases they were a great deal more. This statement appears to be fully borne out by the estimate made of the expense of collecting and disposing of the corn tithe of the parish of Kenninghall (Norfolk), which was published about 1840, and which is reproduced below. This estimate may or may not have been a strictly accurate one, but it is interesting as illustrating the difficulty and expense of collecting and disposing of just one kind of tithe. The system was also objectionable from the point of view of the tithe-payer, inasmuch as it was regarded as a tax of 10 per cent. on the gross returns of the farmer, and, as it increased with the improvement of the cultivation of the land, it was to that extent a deterrent of good husbandry.

ESTIMATE OF THE EXPENSES OF COLLECTING AND DISPOSING OF THE CORN TITHES IN THE PARISH OF KENNINGHALL.

	£	*s.*	*d.*
Carting 140 acres of tithe corn at 10*s.* per acre .	70	0	0
Thatching of 15 stacks, including broaches, at 7*s.* 6*d.* each	5	12	6
Straw for thatching, &c., 7½ tons at 2*l.* per ton, but being of about half the value when off stacks only	7	10	0
Removing 15 stacks into barn	8	8	9
Threshing 405 combs of wheat at 1*s.* 6*d.* Carting 1*s.*, and selling, porterage, &c., at 6*d.* . .	60	15	0
Threshing 362 combs of barley at 10*d.* Carting at 10*d.*, and selling, porterage, &c., at 6*d.* . .	39	4	4
Threshing 161 combs of oats at 3*d.* Carting, 9*d.*, selling, &c., 6*d.*	15	8	7
Threshing 65 combs of beans and peas at 8*d.* Carting, 1*s.*, and selling, &c., 6*d.* . . .	7	0	10

	£	*s.*	*d.*
Hire of stackyard	2	0	0
Repair of barn, sacks, implements, and insurance .	5	0	0
Depreciation of wheat, 405 combs at 6*d.* . .	10	2	6
„ barley, 362 „ 1*s.* . .	18	2	0
„ oats, 161 „ 6*d.* . .	4	0	6
„ beans and peas, 65 combs at 1*s.* .	3	5	0
Carriage and sale of 34 tons 10 cwt. of wheat straw at 15*s.* per ton	25	10	0
Expenses of sale of chaff colder and waste of wheat straw at 1*s.* per acre on 66 acres . . .	3	6	0
Carriage and sale of 41½ tons of barley and oat straw at 15*s.*	31	2	6
Sale of barley and oat chaff and waste straw at 1*s.* per acre on 64 acres.	3	4	0
Expenses of sale of bean straw at 5*s.* per acre on 11 acres	2	15	0
Total expenses . . .	£322	7	6

Moduses.—In the circumstances it is not surprising that in certain parishes in very early times a composition called a "modus" was made among the parson, patron, ordinary, and landowners, whereby the landowners agreed to pay the parson for the time being for ever a certain sum of money or other thing in lieu of tithe. Under the Tithe Acts, 1836 to 1891, practically all moduses have been commuted into tithe rentcharge, but the term "modus" is often erroneously applied to certain tithe rentcharge payable under the Tithe Acts, and sometimes to corn rents or other payments in lieu of tithe imposed by local Acts, or by awards made under such Acts.

Commutations under Local Acts.—Later on, about the middle of the eighteenth century, when a period of great activity in enclosing common fields and waste lands set in, provisions began to be inserted in the numerous local Inclosure and other Acts then passed for commuting the tithes either for allotments of land or for yearly money payments, or for both together. Such payments were in some cases imposed by the Act itself, and in other cases by an award made under the Act. They are recoverable as provided by the local Act, and the procedure for recovery prescribed by the Tithe Act, 1891, does not apply to them. Where such payments are variable corn rents, they may be converted into tithe rentcharge under the Tithe Act, 1860, as amended by the Tithe Act, 1918, by an award of the Board of Agriculture and Fisheries, at any time on the application in writing of the owners of land liable to the payment of the major part in value of the corn rents or

of the persons to whom the major part in value of the corn rents are payable. Under the Tithe Act, 1918, the tithe rentcharge to be awarded on the conversion of any corn rents is to be such as, in the opinion of the Board, is equal in capital value to the corn rents converted.

Commutation under Tithe Act, 1836.—The Tithe Act, 1836, provided for the commutation into tithe rentcharge of all the remaining tithes in England and Wales with certain insignificant exceptions. The first step was to ascertain the total amount of rentcharge to be paid to each titheowner in each parish. This might be settled by an agreement executed by owners representing two-thirds in value of the titheable lands, two-thirds of the great tithes, and two-thirds of the small tithes. In the case of ecclesiastical tithes such agreement had to be approved by the patron of the living, and communicated to the bishop, and every agreement had to be confirmed by the Tithe Commissioners. Failing such an agreement, the Tithe Commissioners, either by themselves or by an assistant commissioner, awarded the sum to be paid.

Section 37 of the Tithe Act, 1836, enacted that where the rent charge was fixed by an award the amount should be ascertained by taking the average annual value of the tithes or the modus or other composition paid in lieu of tithes, during the seven years preceding Christmas, 1835, after making all just deductions on account of the expenses of collecting, preparing for sale, and marketing, where the tithes had been taken in kind. But under Section 38 of the Act the Commissioners had a discretion to increase or diminish this average to the extent of 20 per cent. Section 37 further provided that, in estimating the value of tithes for the purposes of commutation, no deduction was to be made by the Commissioners on account of any parliamentary, parochial, county, and other rates, charges, and assessments, to which the tithes were liable. For some years prior to the passing of the Poor Law Act, 1834, it had been the practice in many parishes, by means of labour rates and other abuses of the old Poor Law system, to throw every charge that was possible upon the poor rates. As a result the net incomes of many of the clerical and other tithe owners had been reduced to very small sums, and if the rates paid during the seven years preceding Christmas, 1835, had been deducted from the rentcharge, scarcely anything would have been left to the titheowner in such cases. The provision in question, however, ensured to them that they should derive the full benefit of the reduction of poor rates which followed the enactment of the Poor Law Act, 1834. Where the tithes had been leased or compounded for on the principle of the rent or composition's being paid free from all such rates,

charges, and assessments, or any part thereof, the Commissioners were required by Section 37 to make an equivalent addition to the value of the tithes on account of such rates, &c.

The Apportionment.—The total tithe rentcharge for the parish having been fixed, the next step was to apportion this total among the various properties situate in the parish, and to prepare a map to illustrate the apportionment, so as to enable any person readily to ascertain the exact amount chargeable on any property. Valuers appointed at a parochial meeting apportioned the rentcharge among the several lands of the parish, either according to principles of apportionment agreed upon by the landowners, or, if no principles were agreed upon, then, having regard to the average titheable produce and productive quality of the lands, but so that in each case the several lands should have the full benefit of every modus and composition real, prescriptive, and customary payment, and of every exemption from or non-liability to tithes relating to the said lands respectively, and having regard to the several tithes to which the said lands were severally liable. On reference to many apportionments it will be found that the rates per acre at which different fields in the same parish are charged with tithe rentcharge frequently differ very widely, and that the amounts of the charge are far from being proportionate to the present annual values of the lands.

The form of schedule to an apportionment provides spaces for showing the names of the landowners and occupiers, the numbers of the enclosures on the tithe map, the names and descriptions of each enclosure, the state of cultivation (whether arable, pasture, garden, or woodland), the areas, and the amounts of rentcharge. Section 5 of the Tithe Act, 1837, provided, however, that it should not be necessary to show, in any apportionment made in consequence of a parochial agreement, the state of cultivation of or the amount charged on the several closes of every individual landowner, if three-fourths of the landowners so requested the Commissioners in writing; and Section 21 of the Tithe Act, 1840, required that the apportionment should be upon each piece of land or close, unless a majority of the landowners required the contrary, though this section did not interfere with the foregoing provisions as to the statement of cultivation. As a result, some apportionments are "field apportionments," and some are "estate" or "farm" apportionments. In the latter the whole of the lands included in one farm or occupation are charged jointly with rentcharge, whereas in the former each field is separately charged. It is believed that in about half the parishes in England and Wales the tithe apportionments are field apportionments, and that the total amount of separate tithe

rentcharges not exceeding 20*s.* is about 480,000*l.* In some parishes where the total amount of rentcharge is small, and the enclosures are numerous, the rentcharges are extremely small, and sums of $\frac{1}{4}d.$ are by no means uncommon. On the other hand, in some parishes where the whole of the lands are in one ownership, there is only one rentcharge of several hundred pounds charged upon the whole parish. In these circumstances it will readily be understood that the cost of the collection of tithe rentcharge in different parishes varies considerably. In some instances the cost is practically nothing, while in others it may amount to 15 per cent., or even 20 per cent. of the amount collected, the average being probably about **5** per cent.

Custody of Apportionments and Maps. — The original apportionments and maps are in the custody of the Board of Agriculture, 3, St. James's Square, London, S.W. 1. Under Section 64 of the Tithe Act, 1836, one sealed copy of each apportionment, with map, was required to be deposited with the registrar of the diocese, and another with the incumbent and churchwardens or chapelwardens of the parish, or such other fit person as the Tithe Commissioners should approve, to be kept by them and their successors in office with the public books, writings and papers of the parish. The usual rule was to deposit the documents with the incumbent or churchwarden or chapelwarden, but where there was no resident incumbent or churchwarden or chapelwarden other custodians were appointed. Thus in Barwick (Norfolk) the copy was deposited with the lay impropriator; in Buckholt (Hants) with the agent of the principal landowner; and in Haslour (Stafford) with the one resident landowner. The Bawsey (Norfolk) copy was deposited with the nearest resident landowner, whose house was, however, no less than five miles distant from the parish, while in the case of Llangunnock (Monmouth) the copy was sent by the Commissioners to a Mr. Matthew Vaughan "to be kept by him and his successors in the occupation of the house in which he resided, being the only one in the parish." According to a memorandum published by the Board of Agriculture and Fisheries, many of the parish copies or apportionments are already in a worn and damaged state, while some have gone from the proper custody into private hands, and others are entirely lost. This is no doubt due partly to the fact that it is not unusual for the custodians to lend the document out of their custody, and partly to the unfortunate practice of some custodians of unlawfully allowing the collector of the tithe rentcharge to keep the document even in cases where his residence and place of business are out of the parish.

There appears to be a widespread fallacy that these parish copies were sent to the incumbents solely in order to assist them in the collection of the tithe rentcharge payable to them, but it should be remembered that the documents were prepared at the expense of the landowners and that the titheowner, as such, was not required under the Tithe Acts to contribute thereto. Moreover, Section 64 of the Tithe Act, 1836, provides that the documents shall be kept with the parish records to be available for inspection, and the incumbent and churchwardens are jointly and equally responsible for the safe custody of the documents. The fact that the incumbent does not own any portion of the tithe rentcharge set out in the apportionment has no necessary bearing upon the question whether or not he, jointly with his churchwardens, should hold the document, nor, of course, is it any excuse for the loss of the document which has sometimes occurred in such cases.

Variation in Value of Tithe Rentcharge.—Section 57 of the Tithe Act, 1836, enacted that every tithe rentcharge at the time of the confirmation of the apportionment should be deemed to be of the value of such quantities of wheat, barley and oats as the same would purchase in case one third part thereof were laid out in wheat, another third part in barley, and the remaining third part in oats, at the average prices for the seven years ended Christmas, 1835.

These average prices were given in the *London Gazette* of August 24, 1836, as 7*s.* 1¼*d.*, 3*s.* 11½*d.*, and 2*s.* 9*d.* per bushel for wheat, barley and oats respectively. There was an error in this return, which was made up to the end of December by mistake, instead of to Christmas. This error was corrected by an advertisement in the *London Gazette* on Friday, December 9, 1836, which stated that the price of wheat ought to have been given as 7*s.* 0¼*d.* Section 7 of the Tithe Act, 1837, confirmed the figures as thus amended.

The Tithe Act, 1836, further provided that after every first day of January the sum payable in respect of the tithe rentcharge should vary, so as always to consist of the price of the same quantities of wheat, barley and oats respectively, according to the average prices for the seven years ended the next preceding Christmas. It was originally intended that in the apportionment there should be four columns for each rentcharge, one showing the money rentcharge, and the others the equivalent in wheat, barley and oats. With a view to saving as much as possible the time and labour of those who might have to calculate the corn rents to be inserted in apportionments, Mr. Henry Pyne, of the Tithe Commission, published in 1837 a Table from which the corn equivalents of any rentcharge could readily be ascertained. This Table

was sometimes referred to as the "Tithe Commutation Table," and was entirely different from the Tables which are popularly called "Tithe Commutation Tables" at the present day. Such Tables show the varied values of tithe rentcharge from year to year, and, strictly speaking, have no bearing upon tithes or commutation. Section 4 of the Tithe Act, 1837, enacted, however, that the quantities of wheat, barley and oats that each rentcharge would purchase need not be stated, provided that, firstly, the whole amount of the tithe rentcharge to be paid in lieu of the tithes for the parish or district, secondly, the total amount of corn in wheat, barley and oats on which the amount of the rentcharge was fixed, and, thirdly, the several sums of money apportioned on each estate were respectively mentioned. The total number of bushels of wheat, barley and oats usually appears before the schedule to the apportionment and is shown to five places of decimals. The equivalents in the case of 100*l.* rentcharge would be 94·95549 bushels of wheat, 168·42105 bushels of barley, and 242·42424 bushels of oats. The tithe apportionment of Melksham (Norfolk) is the only apportionment known to the writer in which the equivalents in bushels of wheat, barley and oats are shown against each separate farm.

It is interesting to recall that the expedient of substituting corn, which is not liable to the same deterioration as money, was adopted as regards college leases by the Statute 18 Eliz., c. 6, which directed that one-third of the old rent, then paid, should for the future be reserved in wheat or malt, reserving a quarter of the wheat for each 6*s.* 8*d.*, or a quarter of malt for every 5*s.*, or that the lessees should pay for the same according to the price for which wheat and malt should be sold in the market next adjoining to the respective colleges on the market day before the rent became due. According to Strype's *Annals of the Reformation*, Vol. II., pt. 2, ch. v., p. 69, this Act was procured by Sir William Cecil, Lord Chancellor of England and Chancellor of the University of Cambridge, and Sir Thomas Smith, Queen Elizabeth's secretary. The same principle was followed in the Sebergham (Cumberland) Inclosure Act, 1771, which provided that all the tithes of the parish should be commuted by a corn rent or yearly money payment equal in value to 267 bushels, 1 peck, 1 quart, and $1\frac{1}{4}$ pints of wheat, Winchester measure, according to the prices of grain, as settled by the Grand Jury at their Michaelmas Session in each respective year. Prior to the general Tithe Commutation Act, 1836, about 224 local Acts had been passed creating variable corn rents in lieu of tithes.

As a rule, these Acts stated the quantity of wheat to be paid or authorised its ascertainment, and provided means for

fixing the equivalent in money from time to time, usually by application to Quarter Sessions at fixed intervals, in some cases five years, in some seven, in some fourteen, in some fifteen, and in some twenty-one. The price on which the corn rents were to be re-ascertained was usually the average for the same period of years immediately preceding the re-ascertainment. In the case of the Pontefract (Yorks) Inclosure Act, however, it was provided that the period for re-ascertainment should be seven years, but that the basis of the calculation should be the average for the previous fourteen years. It appears to have been assumed that the price of wheat bore a more or less fixed relation to the price of every other kind of grain, but when Sir Robert Peel, Chancellor of the Exchequer, moved in 1835 his resolution relating to commutation, he pointed out that the experience of late years had very much disturbed that theory, and he therefore suggested that the tithe rentcharge which he proposed should be made payable on the triple basis of the prices of wheat, barley and oats, and, as above stated, this advice was adopted by the Legislature in the following year, when the first general Tithe Commutation Act was passed.

II.—THE TITHE ACT, 1918.

During the 83 years which have elapsed since the passing of the Tithe Act, 1836, tithe rentcharge has undergone most remarkable fluctuations. In the earlier part of this period the annual variations were, on the whole, favourable to the receiver of the rentcharge, and in the three years, 1874, 1875, and 1878, its value rose as high as 112*l.* per cent., but after 1878 there was a continuous decrease until 1901, when the value dropped to 66*l.* 10*s.* 9¼*d.* When war broke out, the value had risen to 74*l.* 14*s.* 9¾*d.*, and in 1918 it stood at 109*l.* 3*s.* 11*d.* Assuming that the high corn prices of 1917 had continued during the seven years, 1918 to 1924, the value of each 100*l.* of tithe rentcharge in 1925 would have been about 188*l.* 9*s.* 7½*d.*, or nearly three times the value for 1901.

In the early part of 1918, when, owing to various circumstances, the future course of corn prices was exceptionally difficult to estimate, the bare possibility of such an increase caused some consternation among landowners, many of whom urged that a limit should be placed upon the rise. Landowners as a whole admitted that, in increasing with the septennial average prices of corn, tithe rentcharge was merely doing what the Legislature intended that it should do, but they pointed out that the increase in corn prices was mainly due to the activities of the "U" boats and other factors which were quite outside the contemplation of the parties to the statutory bargain in 1836.

Corn Production Act, 1917.—The uneasiness of landowners was accentuated by a misunderstanding prevalent among them as to the effect of the Corn Production Act, 1917, on the value of tithe rentcharge. As already explained, the amount payable in respect of any tithe rentcharge had varied in accordance with the average market prices of wheat, barley, and oats for the seven preceding years, as published in the *London Gazette*. The provision in the Corn Production Act, 1917, securing certain payments to the grower, where the year's price of either wheat or oats, determined as prescribed by the Act, falls below the "minimum" price specified in the Act, does not affect the *London Gazette* prices, and the Act contains no provision which would prevent a landowner from obtaining an increased rent to cover his increased outgoings, including tithe rentcharge, provided that the effect of the guaranteed prices is left out of the account. In practice, however, rents cannot easily be adjusted, particularly where there is a sitting tenant, to meet such great increases of tithe rentcharge as have occurred during the past few years, and it would create chaos in agriculture if any such adjustment were attempted.

Alteration in the Basis of Annual Variations of Tithe Rentcharge.—In all the circumstances, and with the certainty of substantial increases in the value of tithe rentcharge in 1919, and following years, it was generally felt that the titheowner should make some concession to the landowner to meet the exceptional situation which has arisen chiefly as a result of unforeseen war conditions. With this in view, the President of the Board of Agriculture and Fisheries introduced into Parliament the Tithe Bill, which passed into law on November 21, 1918. Under this new Act the sum payable in respect of any tithe rentcharge due on or before the 1st January, 1926, is to be ascertained by the septennial average prices published in January, 1918, so that for the next seven years the value of 100*l.* tithe rentcharge will remain at 109*l.* 3*s.* 11*d.* After the 1st January, 1926, the value is to vary from year to year, in accordance with the average prices of wheat, barley and oats, for the fifteen preceding years. Thus the titheowner will surrender for seven years any excess over 109*l.* 3*s.* 11*d.* per cent. to which he would have been entitled under previous legislation, but, after that period he will enjoy the advantage of having the extremely high war prices of both 1917 and 1918 included in the calculation of the value of the tithe rentcharge until January 1, 1933, when the prices of 1917 will drop out of the quindecennial calculation, and those of 1918 will be excluded after January 1, 1934. In the long run, therefore, the titheowner may not lose very much by this amendment of the law. The substitution of a quindecennial

for the old septennial basis will cause the fluctuations in the value of tithe rentcharge to be less marked than heretofore, and will thus make the titheowner's income more secure, while, from the point of view of the landowner, the change will probably prove satisfactory, inasmuch as it is likely to cause the annual fluctuations to follow the course of rents more closely than in the past.

In the many discussions on tithe rent charges which took place in the early part of 1918, one of the most frequently suggested solutions of the problem arising from the rapid increase of value was that greater facilities should be provided for redemption. Until the passing of the Tithe Act, 1918, the provisions for redemption were all contained in the Tithe Acts, 1846, 1860, and 1878. The following brief account of the law relating to redemption as it existed prior to the passing of the Tithe Act, 1918, is reproduced from the summary of the Tithe Acts prepared by the writer of this article which had been appended to the annual "Tithe Rentcharge Table" for each of the years 1911 to 1918.

Circumstances in which Tithe Rentcharge could be redeemed, and who could apply.—Applications for redemption could be made to the Board of Agriculture and Fisheries as follows :—

(*a*) When the land had been taken for places of worship, cemeteries, schools under the Elementary Education Acts, town halls, court houses, gaols, lunatic asylums, hospitals, or any other public buildings, or under the Artizans' Dwellings Act, 1875, or for sewage farms under the Sanitary Acts, or for the construction of any sewers or sewage works, or any gas or waterworks, or for enlarging or improving premises used for any of the above-mentioned purposes.

The Tithe Act, 1878, section 1, required that the rentcharges shall be redeemed in these cases, and the application had to be made by the persons in possession of the land before the land was applied to any of the purposes aforesaid.

(*b*) When the land is charged with a rentcharge not exceeding 20*s*.

In this case application might be made by the landowner, or by the owner of the tithe rentcharge, and the rentcharge was redeemable, if the Board saw fit (Tithe Act, 1878, section 3).

(*c*) When the land was charged with a rentcharge exceeding 20*s*.

In this case the rentcharge might be redeemed on the joint application of the owner of the land and the owner of the tithe rentcharge, but when the rentcharge was held in right of a benefice, the consents of bishop and patron were also

necessary, and might be signified on the application (Tithe Act, 1878, section 4).

(*d*) When the land charged with a rentcharge of any amount had been divided since the last apportionment into numerous plots for building or other purposes, so that no further apportionment could conveniently be made.

In this case the application might be made by the owner of any of the plots, or by the owner of the tithe rentcharge (Tithe Act, 1860, section 32 ; and Tithe Act, 1878, section 5).

It will be observed that the Board might order redemption on the sole application of the owner of the tithe rentcharge in cases coming under (*b*) or (*d*), and on the sole application of the landowner in cases coming under (*a*), (*b*), or (*d*). In cases, however, which came under (*c*), but not under (*a*) or (*d*) as well, a joint application was necessary.

The Cost of Redemption.—The cost of redemption, so far as the Board of Agriculture and Fisheries were concerned, includes the redemption money and the official fees. In cases coming under paragraphs (*a*), (*b*), and (*d*) *supra*, the redemption money was twenty-five times the nominal or par value of the rentcharge as stated in the Tithe Apportionment ; while, in cases coming under paragraph (*c*), but not under (*a*) or (*d*), it was *not less than* twenty-five times the nominal or par value of the rentcharge. Where the cost of redemption was not paid voluntarily, such cost was equitably assessed by the Board among all the properties liable for the rentcharge, and the assessments were collected by the Board from the owners of such properties.

Except as regards the terms for redemption, the provisions of Section 1 of the Tithe Act, 1878, still hold good, and the powers of a titheowner under Sections 3 and 5 of the Tithe Act, 1878, and of an owner of part of the land under Section 32 of the Tithe Act, 1860, to apply for compulsory redemption as against the other landowners concerned remain unaltered by the Act of 1918, but Section 4 of the Act of 1878 has been repealed by the new Act, Section 3 of which provides that a tithe rentcharge of any amount shall, on the application of the owner of the land, and without the consent of the owner of the rentcharge, be directed by the Board to be redeemed unless, owing to any exceptional circumstances, the Board otherwise direct.

How Amount of Redemption Money is fixed under New Act.—The amount of the consideration money payable on the redemption of a tithe rentcharge may under the new Act be agreed by the owners of the land and of the rentcharge. No such agreement is valid :—

(*a*) If made by a spiritual person entitled in respect of his benefice or cure, except with the consent of Queen Anne's

Bounty, or, in the case of a rentcharge affected by the Welsh Church Act, 1914, of the Welsh Church Commissioners; or

(*b*) If made by a person (not being a spiritual person so entitled), who is not empowered to sell the rentcharge unless he obtains the consent of some other person, except with the consent of that other person.

In default of an agreement as to the amount of the consideration the Board, on the application of the owner of the rentcharge, or of the owner of the land or any part thereof, determine what is fair compensation for the redemption in accordance with the following method :—

(*a*) The Board are required to estimate the annual sum payable in perpetuity which is equal to the variable rentcharge, and the sum so estimated is termed the gross annual value.

(*b*) The compensation for redemption will be such sum as in the opinion of the Board is sufficient, after payment of the cost of investment, to produce when invested in Government securities a permanent annuity equal to the gross annual value after deducting from that value the average amount paid or payable by the titheowner in respect of the rentcharge for the three years immediately preceding the date of the application to redeem on account of rates and land tax, and such sum not exceeding $2\frac{1}{2}$ per cent. of the gross annual value as in the opinion of the Board represents the necessary cost of collection of the rentcharge.

(*c*) For the purpose of the redemption of a rentcharge for the redemption of which an application is made on or before the 1st January, 1921, the gross annual value of the rentcharge will be the original commuted amount thereof, and the compensation will be twenty-one times that amount after the above-mentioned deductions therefrom.

Redemption now an Attractive Investment.—The old redemption terms of not less than twenty-five years' purchase of the par value of the tithe rentcharge were very unattractive to the landowner, particularly in view of the fact that one of the results of redemption is in effect to transfer to the landowner the rates formerly payable in respect of the tithe rentcharge. In the circumstances it is not surprising that out of an original total of 4,054,405*l.* of tithe rentcharge apportioned on lands in this country only about 73,500*l.* or 1·7 per cent. has been extinguished by redemption since the redemption provisions of the Tithe Acts have been in force, and even this comparatively small sum includes a large proportion of tithe rentcharge which has been extinguished compulsorily as against landowners.

One of the chief objects of the new Act is to encourage redemption, and an examination of the effect of the provisions

of the Act which have been set forth above will show that redemption on the new terms should prove an attractive investment to the landowner. Taking as an example 100*l.* of tithe rentcharge (par value) attached to a benefice, and assuming that the average rates and land tax for the past three years amounted to 8*l.* 5*s.* and 16*s.* 6*d.* respectively, and that the cost of collection is 2*l.* 10*s.*, the total deduction to be made from the "gross annual value" which, as above explained, is fixed for the next two years at par, is 11*l.* 11*s.* 6*d.*, thus giving a net annual value of 88*l.* 8*s.* 6*d.* Multiplying this result by 21, as prescribed by the Act, one arrives at 1,856*l.* 18*s.* 6*d.* as the redemption money, or just over $18\frac{1}{2}$ years' purchase of the par value. As the owner of tithe rentcharge not attached to a benefice is not entitled to the remission of the half rate provided for in the Tithe Rentcharge (Rates) Act, 1899, the average amount of rates to be deducted if 100*l.* tithe rentcharge were held by a layman would, on the above assumptions, be 16*l.* 10*s.*, and it would be found that the consideration money for its redemption under the new Act would be 1,683*l.* 13*s.* 6*d.* for 100*l.*, or just over $16\frac{3}{4}$ years' purchase, instead of "not less than" 25 years' purchase as formerly. It is perhaps hardly necessary to state that the amount of the consideration money will vary in different parishes according to whether the deductions for rates and land tax are greater or less and that for the cost of collection less than those in the foregoing two hypothetical cases.

Payment of Redemption Money by means of an Annuity for a Term of Years.—An agreement as to the amount of the consideration money may provide that the consideration money hall be discharged by an annuity payable yearly or half-yearly or a period, not exceeding fifty years, consisting of interest at rate not exceeding 5 per cent. per annum on the consideration noney, and of such sum as would be sufficient if the periodical payments thereof were accumulated at compound interest at a rate not exceeding 4 per cent. per annum, to produce an amount equal to the consideration money at the end of the said period. In default of an agreement as to the amount of the consideration money, the Board may, if they think fit, on the application of the owner of the land or any part thereof, for the purpose of the redemption of a rentcharge for the redemption of which an application is made on or before January 1, 1921, determine that the consideration money shall be paid by an annuity of this kind.

Assuming that, by the agreement of the parties or the determination of the Board, the annuity is to run for fifty years, that the interest on the consideration money is fixed at 5 per cent., and that 4 per cent. is the rate at which the periodical

payments are to be accumulated at compound interest, the resulting annuity to discharge the consideration money amounting to 1,856*l.* 18*s.* 6*d.* for the redemption of the 100*l.* rentcharge attached to a benefice, as calculated in the above example, would be 1,856*l.* 18*s.* 6*d.* × ·00655020 (see "The Tithe Rentcharge Table," 1919) + 5 per cent. of 1,856*l.* 18*s.* 6*d.* = 105*l.* 0*s.* 2*d.*, while the annuity equivalent to the consideration money amounting to 1,683*l.* 13*s.* 6*d.* in respect of 100*l.* lay tithe rentcharge would, by a similar calculation, work out at 95*l.* 4*s.* 2*d.* only.

Redemption in respect of part only of Area Charged.—Many of the landowners who will desire to take advantage of these terms for redemption laid down by the new Act will find on reference to the tithe apportionment and the altered apportionments, if any, relating thereto that their properties are not separately charged with tithe rentcharge, but form parts of larger areas charged with tithe rentcharge. Where it is desired to free from liability to tithe rentcharge a part only of an area charged with a separate tithe rentcharge, without freeing the rest of the area, an altered apportionment to fix the amount chargeable on the part to be so freed, must precede redemption. Such altered apportionment is not practicable if it involves the imposition of any rentcharge less than 5*s.*, the minimum of subdivision by altered apportionment permitted by the Tithe Acts. If no such altered apportionment is practicable, the entire rentcharge may usually be redeemed compulsorily on the application of either the landowner under Section 32 of the Tithe Act, 1860, of the titheowner under Section 5 of the Tithe Act, 1878, to which sections reference has already been made.

Redemption does not Involve Increase in Increment Value Duty on Land.—Under Section 25 (3) of the Finance (1909–10) Act, 1910, the "total value" of land is arrived at by deducting from the "gross value" the amount by which the "gross value" would be diminished if the land were sold subject to any "fixed charges," and, by the definition in the Act, "fixed charges" include *inter alia* tithe rentcharge. Tithe rentcharge was therefore a deduction for the purpose of arriving at the "original site value" which was derived from the "total value."

The "site value" of land on any occasion for the collection of "Increment Value Duty is to be computed under Section 2(2) of the Finance (1909–10) Act, 1910, which in conjunction with Section 25 (4) (*d*) allows of the deduction of any part of the "total value" on the occasion which is proved to the Commissioners of Inland Revenue to be directly attributable to the expenditure of money on the redemption of any fixed charges, including tithe rentcharge. It would thus appear

that there is no ground for the suggestion which is sometimes made that one result of the redemption of tithe rentcharge must be to increase the Increment Value of the land affected and therefore the amount of Increment Value Duty which will be payable on the next occasion on which such duty becomes due.

Corn Rent Redemption.—The foregoing provisions for the redemption of tithe rentcharge extend also to corn rents and other rentcharges and money payments in lieu of tithe which have been imposed by local Inclosure and other local Acts, except that where the Board determine the amount of compensation, the method for such determination as above described does not apply, and it is left entirely to the Board to determine according to the circumstances of each particular case what is fair compensation for the redemption. The 4 per cent. extraordinary rentcharge imposed by the Extraordinary Tithe Redemption Act, 1886, is, however, still redeemable under that Act on payment of the amount of the capital value as set forth in the Parish Certificate of Capital Value.

Altered Apportionment.—Where part of the land charged with a tithe rentcharge is sold, or the whole of such land is sold to different purchasers, a mere informal apportionment of the rentcharge is frequently made by the terms of the contract or conditions of sale ; but this practice is unsatisfactory and may lead sooner or later to disputes and litigation. The owner of the rentcharge may, and in numerous cases does, altogether disregard the arrangement, and requires the purchaser of one of the portions of the land to pay the entire rentcharge, leaving such purchaser the usually troublesome and expensive task of recovering from each of the other owners of portions of the land a due contribution towards the sum so paid. Even if the owner of the rentcharge consented to the informal apportionment, his consent would not in all cases be effectual so as to make the arrangement binding on all persons who might be his successors in title. Moreover, after some time has elapsed and the various portions of land have again changed hands, the informal apportionment will probably be disputed by subsequent owners of the lands who may have purchased without notice of the existence of the arrangement. The only effectual method of re-apportioning tithe rentcharge is by means of an altered apportionment made in accordance with the provisions of the Tithe Acts, and confirmed by the Board of Agriculture and Fisheries. The provisions of the Acts as to altered apportionment extend to corn rents and other payments in lieu of tithe which have been imposed by awards made under local Inclosure and other Acts, and to the 4 per cent. rentcharge imposed by the Extraordinary Tithe Redemption Act, 1886.

Merger of Tithe Rentcharge.—Tithe rentcharge does not become merged and extinguished by reason of the fact that the same person owns both the rentcharge and the land on which it is charged. In the following circumstances it may be merged by a declaration, provided that the declaration is in such a form as the Board of Agriculture and Fisheries approve, and is confirmed by the Board, viz. :—

(*a*) Where the titheowner is entitled to the rentcharge in fee simple or fee tail in possession, or has the power of disposing of the fee simple in possession therein, although he does not also own the land charged therewith.

(*b*) Where the titheowner is entitled to the rentcharge as tenant for life, provided that he owns also the land charged with the rentcharge, and that both the rentcharge and the land are settled to the same uses.

(*c*) A tenant for life who does not also own the land can, as a rule, with his trustees and the owner of the land execute a bargain and sale to the intent that the rentcharge shall merge in the land.

(*d*) A university or college who are affected by the University or College Estates Acts and who do not own the land as well as the tithe rentcharge, can also, with the owner of the land and subject to the approval of the Board under those Acts as well as under the Tithe Acts, execute a bargain and sale to the intent that the rentcharge shall merge in the land.

(*e*) A person entitled in equity to tithe rentcharge may execute a declaration of merger in all respects as if he were legally entitled thereto.

(*f*) A clerical incumbent entitled in virtue of his benefice to tithe rentcharge charged on glebe lands of his benefice can merge the rentcharge in the land.

It will be observed that in cases to which (*a*), (*c*), or (*d*) applies tithe rentcharge may be extinguished by merger as an alternative to redemption. So long as the lay titheowner was entitled to not less than 25 years' purchase of the par value of the tithe rentcharge as the consideration for redemption, he was, as a rule, reluctant to accept much less as the consideration for merger. Now, however, that tithe rentcharge is redeemable on lower terms, and the titheowner's consent to redemption is, generally speaking, no longer necessary, it may reasonably be anticipated that the amount of tithe rentcharge yearly extinguished by declaration of merger will increase. As compared with redemption, merger still has the advantages that the procedure is usually simpler and the official fee payable is lower.

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THE CORN TRADE IN 1918.

EFFORTS to preserve a consecutive series of Tables connecting with earlier volumes of the Society's transactions have been definitely defeated by the action of the Government, the powers of which as exercised under the Defence of the Realm Act lie outside the criticism of a non-political paper. The present attempt, therefore, is not one at reconstruction, which under the circumstances is impossible, but at a harvesting of such particulars as are released from the censorship, and gleanable from not undevastated fields of inquiry.

Prices of British produce in 1918 may legally be disclosed, and include the following details of more or less interest to the corn trade. For purposes of comparison the writer takes the old septennial period, though when space and paper allow it will probably be best to accept the basis of the new Tithe Act, 1918, which is fifteen years. The longer comparison will in post-war years reduce the period 1914–18 to scale far more effectively than does the seven years record.

	Wheat (per 480 lb.)	Barley (per 400 lb.)	Oats (per 312 lb.)
1918	72·7	59·0	47·3
1917	75·10	65·0	51·3
1916	58·3	53·4	51·2
1915	53·0	37·5	48·0
1914	35·1	27·2	47·0
1913	31·8	27·4	45·9
1912	34·9	30·10	46·6

The rise in prices which started in 1913 was closely connected with the rising tendency in wages, which has been fully disclosed by various reports to Parliament, to the Board of Agriculture, and since 1917 to the Agricultural Wages Board. The war gave a great impetus to advance, and Orders in Council fixing maximum prices alone prevented 1918 showing a net rise from 1917, even as 1917 had shown a net rise from 1916, and 1916 from 1915.

No official figures are available for British Beans, Peas, Tares, or Buckwheat, but for purposes of reference it may be stated that these four minor crops were saleable throughout the year for 30*s.* per cwt., and at certain periods thereof for 40*s.*

Their production was almost certainly profitable, as was that of Rapeseed, worth 50*s.* to 60*s.* per cwt., and of Mustard seed, worth 55*s.* to 65*s.* The cultivation of Mustard seed, however, was restricted by Orders in Council.

Prices of Empire produce so far as returns are released are as follow :—

	Canadian Wheat (per 480 lb.)	Mauritius Sugar (per cwt.)	Indian Linseed (per ton)	Burmese Rice (per cwt.)
1918 .	77*s.* 6*d.* to 80*s.*	50*s.* to 54*s.*	30*l.* to 40*l.*	26*s.* 3*d.*
1917 .	92*s.*	45*s.*	27*l.* 10*s.*	21*s.*
1916 .	67*s.*	31*s.*	20*l.*	15*s.* 6*d.*
1915 .	54*s.*	15*s.*	12*l.*	12*s.*
1914 .	35*s.* 6*d.*	9*s.*	11*l.*	7*s.* 9*d.*
1913 .	38*s.*	9*s.* 6*d.*	11*l.*	9*s.* 10*d.*
1912 .	41*s.* 9*d.*	18*s.*	17*l.* 10*s.*	13*s.* 6*d.*

All these articles have been sold since 1917 at Government prices only. Imports of Canadian oats at 59*s.* to 59*s.* 6*d.* per 320 lb. cargoes, of Canadian Barley at 66*s.* to 80*s.* per 400 lb. cargoes, of South African Maize at 70*s.* to 80*s.* per 480 lb. cargoes, and of Egyptian Cottonseed at 19*l.* per ton, have also been made by the State. No private trade in any of these staples was allowed in 1918.

Prices of staples produced by Allies and Neutrals include the following. These have been imported under Treaties, the conditions and terms of which have been as rigidly concealed from Parliament as from the public. Prices for 1918 are those charged to British buyers by the Government.

	U.S. Wheat (per 100 lb.)	U.S. Oats (per 320 lb.)	Argentine Maize (per 480 lb.)	Java Sugar (per cwt.)
1918 .	16*s.* 9*d.*	59*s.* 3*d.*	70*s.* to 80*s.*	36*s.*
1917 .	15*s.*	49*s.* 9*d.*	67*s.*	32*s.*
1916 .	12*s.* 9*d.*	33*s.* 9*d.*	47*s.*	30*s.*
1915 .	10*s.* 6*d.*	30*s.*	29*s.*	22*s.*
1914 .	7*s.*	18*s.*	24*s.* 6*d.*	10*s.*
1913 .	7*s.* 5*d.*	20*s.*	25*s.*	6*s.* 9*d.*
1912 .	7*s.* 5*d.*	19*s.* 9*d.*	30*s.* 6*d.*	9*s.*

A comparison of Government selling prices for Flour and Bran with the average price of British Wheat enables us to get a view of the disposal of the produce of the wheat berry in its entirety. These figures will be of no little value to future investigators of the profits of wheat production and flour manufacture. We can only give figures for seven years in this place, but we may mention that Captain R. T. Hinckes, of Foxley, Herefordshire, has most helpfully constructed a complete table as far back as 1891. The paper was read at a meeting of the Herefordshire Farmers' Union, and represents a labour of real public service. Captain Hinckes displayed a

series of illustrative diagrams at the R.A.S.E. meeting of July, 1914. We are permitted to state that the worst prices recorded were in 1894 for Flour, and in 1901 for Bran. The two products of the wheat berry present most interesting divergencies in their annual comparative values, but of course the maxima for both are to be found in recent war quotations.

	Wheat (per 480 lb.)	Flour (per 280 lb.)	Bran (per ton)	Bread (per 4 lb.)
1918	72*s.* 7*d.*	44*s.* 3*d.*	260*s.* to 290*s.*	9*d.*
1917	75*s.* 10*d.*	44*s.* 3*d.* to 62*s.*	280*s.* to 320*s.*	9*d.*
1916	58*s.* 3*d.*	44*s.* 6*d.*	140*s.*	9*d.* to 1*s.*
1915	53*s.*	39*s.* 2*d.*	105*s.*	8*d.* to 10*d.*
1914	35*s.*	26*s.* 6*d.*	120*s.*	6½*d.* to 8*d.*
1913	31*s.* 8*d.*	25*s.* 10*d.*	105*s.*	6½*d.*
1912	34*s.* 9*d.*	26*s.* 9*d.*	100*s.*	6½*d.*

On August 10, 1917, the price of Flour was fixed by Government at 44*s.* 3*d.* per 480 lb. English, 50*s.* 3*d.* foreign. On January 16, 1919, foreign was reduced to 46*s.* 3*d.* Where there is Government intervention it may be sometimes unsafe to average the year's returns, the stocks held at moment of intervention not being disclosed. Thus a good authority has averaged Bran for 1918 at 266*s.* 6*d.*, the Government figures being 260*s.* to 290*s.*, and the sales at 260*s.* were undoubtedly vastly greater than at 290*s.*, so that 275*s.*, which would be the arithmetical average, would clearly be too high.

Imports of the United Kingdom, in millions of cwts., are thus definitely returned, and include all purchases for Government account, though not trans-shipped corn merely put into English ports for war safety, and so forth, and in due course sent on to the Continental users for whom it was originally intended.

	Breadstuffs	Maize	Barley	Oats
1918 . . .	85·4	14·7	5·0	10·9
1917 . . .	105·8	25·0	9·1	12·6
1916 . . .	109·6	34·1	15·8	12·5
1915 . . .	97·0	48·5	12·2	15·6
1914 . . .	114·0	39·0	16·1	14·1
1913 . . .	122·3	49·0	21·7	18·3
1912 . . .	119·0	43·8	20·1	18·4
1911 . . .	108·0	38·6	24·5	18·2
1910 . . .	115·0	37·0	18·3	17·4
1909 . . .	108·9	39·3	21·5	17·8
1908 . . .	114·4	34·2	18·1	14·3
1907 . . .	116·1	53·3	10·3	19·2

Figures were withheld from January 27, 1917, to January 13, 1919, and this gap enabled a control to be exercised which has had far reaching effects, production for British wants and on British account having been greatly stimulated in certain countries which grow corn for export, and materially restricted in others. The Corn Trade has been in effect wielded by the Executive as a political weapon. The country seems in 1918 to have done with 20 per cent. less wheat than in 1917. The addition of barley and potatoes to the loaf about accounts for this, and no actual reduction in the number of loaves eaten appears to have occurred. The disastrous scarcity of feeding stuffs recorded in the above Table speaks for itself.

Home production of wheat in 1918 was most satisfactory, the yield per acre showing no decline either on the new grass lands ploughed compulsorily, or on the old lands, which it had been feared would be suffering from a lack of fertilisers. The following figures give the estimated crops in hand on January 1 of each of the seven years ; of course the stocks of January 1, 1919, represent the yields of 1918, and so on back to January 1, 1913, with its stores of 1912 corn. The figures for the Antipodes are for the *new* crops.

The Wheat Production of leading Countries for seven years.
(Unit, millions of quarters.)

	Jan. 1, 1919	Jan. 1, 1918	Jan. 1, 1917	Jan. 1, 1916	Jan. 1, 1915	Jan. 1, 1914	Jan. 1, 1913
The U.K. .	11·7	8·6	7·2	9·5	7·8	7·1	6·0
The U.S. .	114·7	82·0	86·0	124·0	111·4	95·4	91·0
France . .	22·0	19·0	28·2	30·0	39·2	40·0	41·9
Italy . .	19·0	18·0	25·0	24·0	21·0	26·1	20·8
Peninsula .	20·0	21·0	19·5	18·0	15·5	15·0	14·5
Russia . .	70·0	80·0	105·0	111·0	101·0	120·0	91·0
Roumania .	7·0	6·5	12·8	13·6	6·0	10·0	11·0
Canada . .	24·0	29·0	20·0	34·0	20·0	30·0	28·0
India . .	46·0	46·9	40·0	48·0	40·0	45·0	46·0
Argentina .	22·0	27·3	16·1	16·4	15·4	16·2	17·0
Australia .	9·5	15·4	18·9	22·5	4·0	13·5	12·0

The crucial question is how have the great producing countries shaped to the war? The controlling figures in the above Table will largely be those for January 1, 1914, just before, and January 1, 1919, just after the long strife. Total production in the first case will be found to have been 418,300,000 qrs., and in the second 345,900,000 qrs. There is a net falling off of 72,400,000 qrs. in world production of wheat.

Despite this effect of the war the situation is to-day a healthy one, the side of production, which alone is within our

range here, being considered of itself. The question of transport is at the bottom of all the Russian trouble ; 80 per cent. of the cereal producers are unaffected by the anarchy, but the supply of grain to the centres of consumption is paralysed. The Central European Powers are not here dealt with, but normally they should be fully self-supporting. Before the war their net imports of wheat, barley, and maize were the result of better profits attaching to the exportation of beet sugar, alcoholic products, timber, and other sources of revenue derived from the soil, and occupying land admitting of the growth of the cereals imported.

Wheat Production. The World's Balance Sheet, January 1, 1919. (Qrs., 480 lb.)

	Production	Wants	Surplus	Deficiency
The U.K. . .	11,750,000	34,000,000	—	22,250,000
The U.S. . .	114,750,000	80,000,000	34,750,000	—
France . .	22,000,000	43,000,000	—	21,000,000
Italy . .	19,000,000	29,000,000	—	10,000,000
Peninsula . .	20,000,000	19,500,000	500,000	—
Russia . .	70,000,000	70,000,000	—	—
Roumania .	7,000,000	8,000,000	—	1,000,000
Canada . .	24,000,000	8,000,000	16,000,000	—
India . .	46,000,000	40,000,000	6,000,000	—
Argentina . .	22,000,000	9,000,000	13,000,000	—
Australia . .	9,500,000	5,000,000	4,500,000	—

Net surplus 20,500,000 qrs.

The whole subject of the trade in feeding stuffs in 1918 is enveloped in difficulty, but the dispassionate critic will hesitate to follow the general trend of opinion without taking into consideration the fact that the evils that have been disclosed since 1917 were in existence already, the action of the Government not creating so much as revealing them. It would require the pen of an agricultural economist, and that of the first order, to deal with the basic facts of production for the support of live stock and poultry, nor can the present writer do more than narrate briefly the succession of evils which in 1918 happened on the feeding stuffs market, and will probably be the subject of more than one study in the future.

Barley is a crop grown for two purposes. This fact of itself causes official difficulties of the first order. In 1918 the use for human consumption was officially reduced by one half on the side of drink, and largely increased on the side of food. This double interference stands or falls by reasons absolutely outside agricultural considerations, and in a review of this

character can only be compared to some climatic effect on the actual harvests. The home crop was raised on a fair but not large area, and while under Government orders maltsters have not been allowed to acquire much of it, millers have been ordered to incorporate a material percentage in the loaf. The latter order, however, expired with 1918, and thus we have a return to natural conditions on the side of sales for feeding use from January 1, 1919. Such sales, however, are outside this review. The American production of barley in 1918 was greatly increased, and there were also increased yields in Canada, Spain, Italy, and North Africa. The total yield for the chief producing countries, however, is below what we have been accustomed to find it, as Russia and Roumania have ceased to be exporting countries, and their yields are quite problematical. The following estimate on the basis of our previous tables may be attempted, but it is venturing in some directions on an uncharted sea. At the same time it must be kept in sight that *areas do not disappear*, and that the cultivable land remains even in the most anarchical or afflicted countries. Yields in millions of cwts. :—

	1918	Pre-war (1905-14) average
The U.K.	27·3	29·0
The U.S.A.	112·6	74·0
France	19·0	20·0
Italy	18·3	14·0
Peninsula	32·0	22·0
Russia	150·0	200·0
Roumania	8·0	11·0

Mr. E. H. Godfrey, in his valuable report to the Canadian Government, signalises a large increase in barley production in Canada. The yield in Tunis is put by the French Government report at 21,000,000 cwt., and the Japanese crop is officially reported at 152,000,000 cwt. These regions, however, are not credited with any exportable surpluses. Some barley over and beyond home needs was assigned at the end of 1918 to Argentina, Chilé, and Australia, but no figures were forthcoming.

During 1918 the impediments to a use of barley for feeding purposes were so onerous, and the penalties so severe for infringements, even when of a very minor description, that the use of the staple as feed was very largely discontinued, and both pigs and poultry, where locally kept with a view very materially to the consumption of barley in the district, were

killed off wholesale. The demand for oats was greatly stimulated in all countries. Production of this cereal was fortunately large. An increased area was sown, and the subsequent weather, which showed over an average temperature, together with an over average rainfall, provided a heavy yield per acre. The production of oats in the United Kingdom proved a record. The United States did not quite repeat their record yield of 1917, but the crop was large enough to leave an important surplus available for exportation. Canada had a crop concerning which estimates vary; we follow the more conservative calculations. The Russian crop was disastrously small, as the cultivation is greatest in the area of the most Bolshevist anarchy, the North and West. In France there was happily some recovery from war interference and devastation.

Yields of Oats.
(Millions of cwts.)

	1918	1905-14 (pre-war) average
The U.K.	86·4	60·0
The U.S.A.	523·0	300·0
France	72·0	100·0
Italy	9·0	10·0
Peninsula	8·0	8·0
Russia	200·0	286·0
Roumania	5·0	7·5
Canada	108·0	94·0

The *Times* on January 7 estimated the Argentine crop at over forty million cwt., and this calculation has been borne out by subsequent shipments showing an appreciable export surplus.

With respect to maize, the American production in 1918 left a large surplus available for exportation, but by a convention with the British Government the American exports were withheld for some months, and the corn devoted to the feeding of pigs and poultry, British wants being ministered to by shipments of food in the concentrated or flesh form. As a few months earlier a Government propaganda had been directed to persuading farmers that to raise corn instead of flesh as food was sound policy, the agriculturist viewed this new departure with some surprise. The United Kingdom in pre-war times had in its agriculture and stock-feeding budgeted for ten million quarters of maize for feed use annually. Maize yields in other countries than the United States of America were rather under an average, but the difficulty of selling the surpluses distracted attention from actual yields. The situation

with respect to this crop is somewhat perplexing, but with barley cultivation more or less under a cloud there should be room for an increased importation wherever there is assurance against Government manipulation of supply.

Maize yields.

(Millions of cwts.)

	1918	1905-15 (pre-war) average
The U.S.A.	1368·4	1378·0
France	10·0	11·4
Italy	38·7	50·0
Peninsula	12·0	14·0
Russia	28·0	42·0
Roumania	34·0	51·0
Canada	6·0	9·0
India	18·0	20·0

We do not reckon the Russo-Roumanian production of maize as reduced by more than one-third, for a brace of reasons. In Russia maize is only grown in that part which in 1918 was comparatively free from Bolshevism (the South-east), and in Roumania the back of the enemy had been broken by October, when the crop had to be reaped. We hear that the Roumanian peasantry were not materially molested by the German forces in nominal occupation, and the German surrender came before the crop was available, maize taking two months after reaping before it is fit for food.

With 1919 the leading problem of the trade in barley, oats, and maize, was soon seen to be the replacement of the Russian pre-war production. The reduction on the three cereals is not less than 150,000,000 cwt. Now in 1911 Russia exported 22,000,000 cwt. of maize, in 1910 84,000,000 cwt. of barley, and in 1912 18,000,000 cwt. of oats. The challenge to producers rings out clearly enough. Reckoning these crops at no higher price than ten shillings per cwt. on the farm, there is still 11,000,000*l.* sterling offering for maize, 42,000,000*l.* for barley, and 9,000,000*l.* for oats by the importing countries. The production of feeding corn is capable, therefore, of an immense stimulus. The private importer in 1918 was *civiliter mortuus*. His trade was at an end so far as feeding stuffs went; the Government was the only importer. But the year was not one of intellectual paralysis too. The possibilities of the future were earnestly canvassed, and production in other lands than Russia is already being promoted. India and Australia have been seriously injured by the want of tonnage,

but the extant position is most encouraging for the cultivation of feeding stuffs in Argentina and Brazil, with their direct leaning to Britain. The Canadian development of corn growing counts on labour, which is extremely scarce. If this obstacle were removed the Dominion could produce for us all the feeding barley and oats that we used to buy of Russia. Maize, a typical crop, remains a staple for which we must apparently remain dependent on growers outside the Empire. The chief hope of production under the Flag lies in South Africa, where cultivation is steadily on the increase, and coloured labour admits of comparatively cheap cultivation. The shipping question will decide the destinies of South African maize growing.

Of feeding stuffs other than barley, oats, and maize, it may briefly be remarked that there has been a satisfactory revival in the home cultivation of beans and peas, that France has augmented her cultivation of buckwheat, Spain the growth of canary seed. On the other hand India has lost heart over growing small pulse for exportation, the Government refusing tonnage for the export of gram, jowri, muttor, dari, and other produce. The area under these crops before the war was 41,384,000 acres, and suppression of this improving trade is greatly to be regretted. Another industry which has withered under Government control is the production of soy beans in Japan and Manchuria for the British market. The revival of this commerce is to be desired, for these beans are rich in a digestible oil, and they are of convenient size for poultry feed as well as of value in the form of meal for live stock. It is only just to observe that the Shipping Controller can have had but little choice in the case of a crop grown at the remotest of places so far as import facilities are concerned. Railway transport across Siberia being out of the question, the sea voyages, whether down the Pacific and viâ Cape Horn, or past China and round by Singapore, remained the two longest on the map. Our alliance with China and Japan now leads to hopes of this trade being revived. The past year has seen a great impetus given to the cultivation of the Arachis plant, which yields a nut rich in a mild oil of great feeding value. There is admittedly an important future before this nut crop, and it thrives in comparatively near countries, such as our West African possessions, and the Southern States of the American Union. French possession of Morocco may from now be regarded as effective, and the productivity of that country under civilized rule may become a feature in our future supplies of some very useful feeding stuffs. Feeding barley, millet, and chick peas flourish exceedingly in Morocco, but it is most especially famous for producing *Phalaris*, which has been

mainly known to Englishmen as a bird seed, "canary seed." Dr. Fream, in his Royal Agricultural Society of England "Elements of Agriculture" (January, 1893), was the first to indicate the real position of this graminaceous plant as a true cereal, and subsequent experiments in its use as a feeding stuff have conclusively demonstrated its right to be regarded as valuable for all the purposes of ordinary feed. The fact that fast steamers can bring the produce of Morocco to our shores within five days must invest the produce of the country with a permanent interest in the eyes of British consumers and users of cereals, the more so as French rule brings it to-day within the area of producing regions controlled by civilised rulers.

Farm Seeds in 1918.

The area under rotation grasses and lucerne in England and Wales is over 2,100,000 acres, but the quantity of seed used varies with the choice of the crop and mixture. No returns are published of the yield of farm seeds, and information when obtained by the Food Production Department is treated with much secrecy. During 1918 the institution of a series of Government tests for seeds was effected, and on July 15 a further step was taken in the more or less formal start given to a botanical college at Cambridge, the purposes of which include very prominently the care of farm seeds and seed corn. On March 25 a series of inquiries was sent out to farmers, importers, and dealers. All importers of sainfoin, lucerne, clover, cocksfoot, Timothy, and meadow fescue were obliged to disclose country of origin. The sainfoin and lucerne have mostly come from France, the imported clover seed and Timothy from America, the meadow fescue and cocksfoot from Denmark.

The crops of the year were not at all large, but neither were they particularly deficient. The autumn was not, however, very favourable to the threshing or separation of the seed, and the total stocks in hand on January 1, 1919, were held to be rather below an average. The very drastic tests insisted on by the Government led to inferior hard and old seeds being sold off as feed at 30*s.* to 40*s.* per cwt., while the prices of the good seed were pushed up, and a strong sellers' combination, if not actually constituted, arose out of a spontaneous feeling that if the Government was exacting the community should pay for it. The following list of monthly sales of fourteen principal farm seeds shows that all are dearer on the year, and that in the case of single-cut cow grass the rise of 160*s.* is altogether without precedent. Red clover seed in America has been a subject of much trade movement. Opening at 200*s.* for top grade it fell to 180*s.*, but quickly recovered to

200*s*. There then ensued an autumn speculative "bull" campaign which carried prices to 260*s*. per cwt., a record quotation on December 9. This proved the culminating point, and on December 30 248*s*. was the price. This, however, was 48*s*. net rise on the year. Articles comparatively little altered in price have been Danish cocksfoot and ordinary English *Trifolium incarnatum*. Little or no cocksfoot has arrived from New Zealand, and Chilian clover seed also disappointed last year's would be buyers.

Farm Seeds Prices.

Shillings per cwt.

	Jan.	Feb.	Mar.	April	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Rise
ENGLISH—													
Red Clover Seed	170	168	170	170	190	195	190	190	190	220	250	255	85
White Clover Seed	280	245	230	230	260	255	250	260	290	300	310	325	45
Alsike	140	135	130	135	145	135	135	140	135	155	165	170	30
Single-cut Cow Grass	240	240	235	240	250	300	320	300	310	310	350	400	160
Trefoil	75	75	75	75	75	75	75	75	110	140	140	140	65
Late Trifolium	110	110	110	110	110	115	115	110	110	115	120	125	15
Meadow Fescue	135	145	145	150	155	160	160	165	175	180	190	185	50
Milled Sainfoin	70	100	100	105	105	110	105	105	105	135	150	170	100
FRENCH—													
Lucerne	120	125	125	125	125	125	125	130	135	140	140	145	25
DANISH—													
Cocksfoot	170	160	160	155	155	155	155	165	175	180	190	180	10
AMERICAN—													
Timothy	70	75	70	70	70	75	75	80	90	100	105	110	40
Alsike	140	135	140	135	155	170	160	155	170	175	185	190	50
Red Clover Seed	200	205	230	240	240	240	240	235	250	290	300	310	110
NEW ZEALAND—													
Hard Fescue	115	125	135	—	—	—	180	160	170	180	190	190	75

The establishment of first-class seedsmen's prices for farm seeds generally will not be without a good effect, for the wide awake farmer will reflect that under the circumstances the wisest thing will be to go at once to the fountain head and buy of houses whose name assures the most scientific selection of the finest seed well saved. To add substantially to the yield of grass land per acre is in reality the proper correlative to increasing the area compulsorily devoted to arable. Sales of minor and special seeds has been rather good. A run on wild white clover seed had by November carried the price to 20*s*. per lb., and we have already seen the call for single-cut cow grass, which is *T. tardum* or late-ripening variety of *T. perenne*. The very large yields have also tempted cultivators as well as the great advantage of a really late crop to supplement the ordinary clovers. Yarrow and *Anthyllis* at 7*s*. 6*d*. per lb. have had buyers, the latter for acid soils. A little sweet vernal has been taken at 5*s*. per lb., but the vogue is reduced. Seed maize for cutting in the milky stage had a good sale in May at 20*s*. to 30*s*. per cwt., and there has been a

good demand for sunflower seed, which makes 50*s.* to 60*s.* per cwt. for a sound sample.

Oilseeds and Oilcake in 1918.

The demand for oilseeds and oilcake in 1918 was very brisk but was not at all adequately satisfied. The latest scientific investigations had led to the discovery that fat meat contained less water than lean, and that the sustaining value of fat food had been understated in earlier periods. Nevertheless the Government instituted a more severe rationing for fats than for foods which depend more upon carbohydrates or are less concentrated. The home production of oilseeds is unfortunately insignificant, though linseed and rape seed yield 700 to 750 lb. per acre in this country, and are by no means therefore below a level whereat cultivation must needs be unprofitable. We are, however, almost entirely dependent on overseas production, and the Government, as sole importer, was therefore in a position tc keep supply down. The few lots of home grown oilseeds were not interfered with, and made about 250*s.* per qr. (424 lb.), both linseed and rape seed. The latter had a better demand for seed as a green crop than for use for oil-making. The price of imported seed would have risen so enormously under the restriction of imports that the Government had to fix maximum prices. It also severely limited the quantity saleable to any one purchaser.

The price of linseed advanced during 1918 very noticeably, in Argentina there being a fairly steady advance from January 1, when 15*l.* 12*s.* per ton was quoted, to 26*l.* 12*s.* 6*d.* on September 1. The promise of the new crop was then a relief to the buying interest, and the year closed with 20*l.* 10*s.* ruling. The prices early in 1919 when the crop had been harvested were about 18*l.* 10*s.*, so that the new harvest has materially modified the situation. Nevertheless value is substantially higher than a year ago, and America is a competitor with the United Kingdom for the export surplus, so that cheap Argentine linseed is not to be expected.

America's failure to keep in the list of countries able to export linseed is a surprise and has not been explained. The pre-war price of linseed was about 6*s.* per bushel or 12*l.* per ton, and the production was maintained at 16 to 19 million bushels against 16 millions home needs. The price in 1918 was about 13*s.* 3*d.* per bushel or 26*l.* 10*s.* per ton, yet production has fallen to about 15 million bushels, and a million bushels are now regarded as a very usual import need. Canada has done a good business in linseed in 1918 at about 24*l.* per ton, but is not increasing the cultivation at all freely. New land is wanted or has been wanted for wheat sowings, and on

old land the Canadian yield of this seed is apparently very dubiously remunerative, 500 to 550 lb. per acre only. The crop, however, suits virgin soil, and may give 832 lb. (two quarters) to the acre.

Oilcake prices in 1918 were severely controlled. Linseed cake was kept at a legal maximum of 19*l.* per ton, which excluded all American supply, the price of cake being 21*l.* in America itself. Crushers were much impeded in their work by irregular supply, and also by a withdrawal of machinery, the Ministry of Munitions acquiring rights to commandeer the same. Cotton seed cake at 14*l.* 10*s.* for London, 15*l.* Egyptian made, was held back under various orders; imports from Egypt were for some months forbidden altogether. Rape cake at 14*l.* per ton made an intermittent appearance on the market.

Seed and edible oils have been a feature of 1918 business, and have been much sought after by those useful intermediaries the vendors of proprietary fattening meal of different sorts. The withholding of feeding sugar was a cause of a special inquiry for oils and fats, and has not been explained, stocks at the end of 1918 being very heavy. The prices made for the oils in 1918 were about 60*l.* for coconut and cotton seed, 100*l.* for oleo, 45*l.* for palm oil, 75*l.* for linseed and refined Soya bean, 66*l.* for rape seed, and up to 200*l.* for pure olive oil, all per ton. On this market there were also sold in 1918 Arachis oily nuts at a mean level of 32*l.* per ton, palm kernels at 26*l.* per ton, and sweet or locust beans at various prices, 20*l.* to 40*l.* per ton. The fall in locust beans to 18*l.* in March, 1919, was due to the release of Cyprian surpluses.

The price of linseed in England at the beginning of 1918 was 29*l.* 15*s.* per ton for good Indian and about 27*l.* for Argentine, but the latter soon became almost unobtainable. The price of Indian as the main type on offer was hardening steadily until in June the Government authorised a quotation of 39*l.* for best, 38*l.* for ordinary. By November 40*l.* had been reached, but the armistice made a great difference, and prices fell steadily till in later December 30*l.* was quoted. In 1919 the earlier weeks saw a further decline to 27*l.* for Indian, and a supply of Argentine began to be spoken of as available for spring arrival at 25*l.* per ton. The price of cotton seed on January 1, 1918, was 19*l.* for Egyptian per ton, and a little West African was to be had at 15*l.* to 17*l.* The Government forbade buyers to pay more all through the year, and this resulted in a gradual cessation of all supply. The great injury inflicted on the live stock interest in this country by a prohibition of anything like a free use of cotton seed and its products has been commented upon in various directions, and those who have live stock to tide over difficult feeding periods

are anxious that now cotton seed is once more an article freely imported stocks thereof should be built up. It is, however, a somewhat difficult staple to keep in condition.

Oilseed Prices per ton.

	Linseed	Rape seed	Cotton seed
	£ £	£ *s.* *d.*	£ *s.* *d.*
1918	27 to 40	30 0 0	19 0 0
	£ *s.* *d.*		
1917	29 18 3	26 10 0	18 11 6
1916	20 0 0	17 10 0	14 8 9
1915	14 5 0	13 0 0	9 9 3
1914	12 3 4	12 10 0	8 4 3
1913	12 0 0	13 0 0	—
1912	13 5 0	13 2 6	—

Sales in the early part of 1919 have included Japanese linseed at 24*l.* per ton. Linseed for 1918 may be arranged at 33*l.* 10*s.* for rough purposes of comparison, but the contracts were often secret by Government order, and thus exact knowledge was rendered unprocurable.

Oilcake Prices per ton.

	Linseed	Cotton seed
	£ *s.* *d.*	£ *s.* *d.*
1918	19 0 0	14 10 0
1917	20 10 3	15 13 9
1916	13 17 6	10 16 6
1915	11 1 3	7 8 9
1914	8 3 9	5 5 3

Compound cake at 18*l.* 10*s.* per ton has been a new feature. The Government now insists on a specific analysis, and this has been one of the useful results of control.

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A NOTE ON THE ECONOMY OF SILOS IN FARM MANAGEMENT.

THE most important problem of the present time for those interested in Farm Management is how, and by what means, the increased wages bill is to be met. It is essential for the benefit of the country at large, and especially for the populous and over-crowded towns, that the production of the soil should be increased, not only above pre-war times, but that it should be maintained at a higher productive standard than it has attained to at the present day. With an abundant supply of potash and other artificial manures, with the arable lands being thoroughly cultivated and cleaned of weeds, in addition to being drained where necessary, and with a considerable increase of labour, there is no doubt that it is a possible and not a difficult matter for the agricultural production of this country to show a substantial increase. In bringing back our lands to similar fertile conditions as was the case in the sixties, it must be recognised that manual labour plays an important part. In fact all the farming operations already mentioned as desirable to restore the fertility of our soil, are dependent on labour. With the establishment of the Wages Board, resulting probably in shorter hours, and certainly in increased pay, labour is not the same cheap commodity it was even before the commencement of the war. Neither would one wish to see it. Farmers as a rule welcome the advent of a better time for the farm hands—good cottages, and more time to devote to their home duties—and they raise no objection, provided that prices will be maintained at such a point as to allow a fair profit, together with interest on capital and working expenses connected with farm management.

The question therefore arises how is the cost of labour to be met in the future, or rather, how is labour to be economised? One naturally turns to labour-saving machinery and labour-saving methods of farming, and it is in connection with the latter point that a consideration of the economy of silage is involved. Silage has generally been regarded as an alternative to the hay crop, but it is as a substitute for the root crop that it is now being extensively used in the eastern counties. Of all the purely agricultural crops on the farm none require so much labour as roots. The frequent ploughing, cultivating, and harrowing, all require a certain amount of manual labour, whilst one is entirely dependent upon the farm hands in some form or other for the hoeing, singling, pulling, and carting where necessary; and with this laborious work must be included the pitting, cleaning, and slicing of the roots. From the spring

days of April, when mangold seed is planted, till the roots are consumed by the stock in the following spring, labour is required in order that the crop may perform its allotted task. As the conditions of root growing have changed in regard to this important item of labour, can we not profit by the experience of America, where high wages have ruled for many years?

It will be found that in the United States the acreage of roots cultivated for purely agricultural purposes is comparatively almost negligible, and as a substitute for winter feeding to cattle the silo is much in evidence. The making of ensilage is no new idea with the American farmer, but it has demanded increased attention for the last thirty years, and at the present time it is difficult in some districts to visit a farm homestead of any pretensions and not find an up-to-date silo. The feeding of ensilage has become of such national importance in the States that when it was proposed last year to restrict the use of iron and steel by 25 per cent. on the previous years, it caused such a flood of protests at Washington that the following statement was issued :—"The War Industries Board, being mindful of the importance of Silos as a means of stimulating production and of preserving food, will look with favour upon their construction," and the proposed 25 per cent. reduction was not enforced. In 1882 there were only ninety-one silos erected in the United States; in 1914 this had increased to 750,000. At a congress in Chicago of the American Meat Packers' Association, the President stated that he was looking to the silo to help to save the situation as regards the threatened beef famine which is in sight in the United States. If, therefore, the silo is such an important factor in America, with similar conditions of labour as our own, must we not seriously consider the advisability of looking into the matter with the object of ascertaining if it is not worth while adopting the silo system in our management of the farm. It may be correctly stated that ensilage was on trial in this country some thirty years since, and did not catch on, yet a few farmers made ensilage then, and have continued to use the silo up to the present time. Undoubtedly the present-day method of making silage is a vast improvement on the old manure-heap practice, with its unwarranted waste. Just previous to the war a few wood stave silos were erected on the American principle in this country, but owing to the restriction on timber during the past few years, this had to be discontinued. Those farmers who were fortunate enough to have their silos erected at pre-war prices have reaped an immense advantage.

Most farmers have a fairly accurate idea of the cost of mangold at pre-war prices up to the time they were carted off the land,

but even then there was no allowance made for pitting, carting home and preparing. During the past four years, the expense in cultivating root lands has enormously increased, and labour which could not be spared from the roots was badly needed elsewhere, so consequently other crops had to suffer for the want of it. As to the cost of ensilage, it was estimated at under 9*s.* per ton in 1914. In the same year, a silo with capacity for 160 tons was filled with maize, the produce of twelve acres, and it maintained seventy-five head of stock for twenty weeks without any roots—straw and cake being the only additional feed. This works out at something under 1*s.* per week per head : but it must be added some ten calves were included in the number, the rest being twenty-five milch cows and some of their produce as yearlings and two-year-olds.

Like other commodities, one can readily understand there is good silage and bad silage ; some which animals will readily consume, and some which does not appeal to stock. Decayed and mouldy silage it is not advisable to feed, and given to horses may result in serious loss ; and as it is difficult to avoid at times pieces of mould getting into the manger, it is not recommended as a food for horse stock, but to all cattle, sheep and swine it may be fed with the greatest confidence and with excellent results. But it must not be forgotten that there is a considerable wastage of food-values in the process of making silage. Lawes and Gilbert found that in a stack silo this loss amounted to no less than 30 per cent., and the analysis of maize silage in a stave silo at Wye showed likewise that the chemical changes were attended with serious depreciation of value.

The system of silage farming can be applied to all varieties of soil, but it appears to have special advantages on wet heavy land and on light sandy—the two most difficult classes of land to cultivate at a profit. On the heavy soil, the wheat stubble can be ploughed up in the autumn, it can have another ploughing at the end of March, and maize can be ploughed in at the rate of two bushels per acre by means of a small drill attached to the plough about the middle of May. In a dry spring, a fallow will have been made of the land and if, as is customary, every alternate furrow is planted, the single furrow hoe will soon be able to commence work between the rows and the more this implement of husbandry is in use the better the crop, the fewer the weeds and the better condition the soil will be in for the following crop. On the poor light land soil, oats and tares, at the rate of one bushel of the former to two of the latter with a few beans to hold the tares up, can be drilled in the early autumn, and with twice harrowing in the spring no further expense is necessary till the crop is ready to place in

the silo. In June the soil is then broken up and usually a crop of turnips or mustard can be obtained. Most farmers carrying a flock of breeding ewes on light soil know the difficulty of obtaining feed of a succulent nature in a dry July when all crops are parched from a prolonged drought. With a full silo there is no scarcity, and one great advantage of silage is that if it is not required one year it can be used the next. At the present time over-yeared silage is being fed on an adjoining farm and to all appearances it is equal in quality to that consumed the previous year. Dairy farmers were at one time under the impression that the smell from silage might be detrimental to the keeping of milk. Such, however, is not the case ; some milksellers who have continually fed silage during the winter months for many years past have never had a complaint in this respect from their London buyers.

In 1886–7, some experiments were carried out by Dr. J. Augustus Voelcker on behalf of the Royal Agricultural Society at Woburn, the special object being to ascertain the value of grass silage as against grass made into hay. The results arrived at after feeding two lots of bullocks, one on silage and one on hay, appear to have been only slightly in favour of silage. This is not surprising considering grass is not a suitable crop to put in a silo. However one can readily see that a crop of oats and vetches (tares) grown on arable land in practically half a season will show a considerably better result than a crop of grass converted into silage. *The Journal of the Board of Agriculture* of May last in giving the advantages of silage states :—"Stock fed on silage made from leguminous crops, *i.e.* clover, lucerne, sainfoin, and vetches, will require less oilcake than stock fed on roots ; moreover such crops tend to increase the fertility of the land." "The labour involved in feeding silage is very much less than that of feeding roots."

The two items mentioned, increasing the fertility of the soil and economizing labour are two points which no one can afford to overlook in the present day management of the farm, and the experience of many farmers in the eastern counties is that silage is an aid to the attainment of both these ends.

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CONTEMPORARY AGRICULTURAL LAW.

I.—Legislation.

The year 1918 has produced a considerable amount of legislation affecting agriculture and agricultural interests in this country.

The first statute to be noticed is the Horse Breeding Act, 1918 (8 & 9 Geo. 5, c. 13), passed to regulate the use of stallions for stud purposes. It forbids by Section 1, any person being the owner or having the control of a stallion of a prescribed age after the "appointed day," (being such day not earlier than January 1, 1920, as may be appointed by the Board of Agriculture and Fisheries), travelling it for service or exhibiting it on any premises not in his occupation with a view to its use for service, or permitting it to be so travelled or exhibited unless the stallion is at the time licensed under the Act. Section 2 empowers the Board to grant, revoke and extend licences for the purposes of the Act. Licences are to be granted by the Board on payment of such fee (not exceeding one guinea) as may be prescribed, and the Board may refuse a licence or revoke or suspend a licence if it appears that the stallion is affected with any contagious or infectious disease, or with any other disease or defect prescribed as a disease or defect rendering the stallion unsuitable for service of mares, or has proved to be inadequately prolific, or is calculated if used for stud purposes to injure the breed of horses by reason of its defective conformation or physique. By Section 3, a licence is to remain in force until October 31, following the date of its grant unless previously suspended or revoked by the Board, and it is provided that in the case of a stallion which has attained such age as may be prescribed, and in respect of which a licence shall be in force for such number of years as may be prescribed, the renewal of the licence shall not be refused on the ground only of the stallion being afflicted in its wind. By Section 4 an appeal is given from a refusal or revocation or suspension of a licence by the Board to a member or members of a panel of referees, consisting of veterinary surgeons and other persons appointed by the Board after consultation by the Board with horse-breeding societies who are, in the opinion of the Board, interested in such appointment. The Board may, after the report of the inspection and examination of the stallion by the appointed referee or referees, confirm or vary the decision to which the application relates. The prescribed fee payable on the appeal is not to exceed 5 guineas, which is to be returned to the applicant if the Board do not confirm the decision to which the application relates. By Section 6,

the Board is empowered to inspect or examine stallions, travelled or exhibited for service, by a duly authorised inspector.

The Finance Act, 1918 (8 & 9 Geo. 5, c. 15), imposes on occupiers of agricultural land income tax under Schedule B, on twice the annual value of the land occupied in lieu of one-third the annual value which was the figure in force under Sections 26 and 27 of the Finance Act, 1896, but it is provided that where it is proved to the satisfaction of the Income Tax Commissioners that any person occupying any lands and assessed to Income Tax in respect thereof under Schedule B is not occupying those lands for the purposes of husbandry only, or mainly for those purposes this provision shall, unless the Board of Agriculture and Fisheries on a reference to the Board by the Commissioners of Inland Revenue, certifies that the use of the lands by that person for purposes other than purposes of husbandry is unreasonable, apply in relation to those lands, as if for the reference to an amount equal to twice the annual value, there were substituted a reference to an amount equal to the annual value. This provision will allow an owner of woodland in his own occupation to be assessed in the annual value thereof, instead of twice the annual value. It is to be remembered in the case of occupiers of agricultural land that they may elect to be assessed and charged on their actual profits under Schedule D, instead of on twice the annual value under Schedule B, and also that if any person occupying land for purposes of husbandry and charged under Schedule B, shows that the profits or gains arising from his occupation during the year of assessment fell short of the assessable value of that land under Schedule B, the income arising from the occupation shall be taken at the actual amount of those profits or gains, and he will be entitled to be repaid the amount overpaid (*see* Income Tax Act, 1918 (8 & 9 Geo. 5, c. 40), Schedule B, rules 5 & 6).

The Land Drainage Act, 1918, (8 & 9 Geo. 5, c. 17), was passed to amend the Land Drainage Act, 1861, (24 & 25 Vict., c. 133), and to make further provision for the drainage of agricultural land. It provides by Section 1 that subject in the case of approved orders to confirmation by Parliament, the Board of Agriculture and Fisheries may (*a*) constitute any area a separate drainage district for the purposes of Part II. of the Land Drainage Act, 1861, and include therein the whole or any part of any existing drainage area, and provide for the constitution of the Drainage Board for the district ; (*b*) alter the boundaries of any drainage area ; (*c*) define the limits of any commission of sewers ; and (*d*) confer on any drainage authority such additional powers of levying drainage rates or

borrowing powers as may be necessary or expedient, and alter or supplement the provisions of any local Act, or of any award made under any such Act where such alterations or supplemental provisions are in the opinion of the Board necessary or expedient for enabling the area to be drained effectually. Section 2 contains provision for the procedure to be adopted to obtain an order of the Board under the Act. It may be obtained upon petition by proprietors of one-tenth of the area affected or the drainage authority of a drainage area, or the council of any administrative county or county borough in which the land proposed to be affected is situate. Sections 3 and 4 contain provisions for the expenses of making an order and for rating. Section 5 enables local authorities to contribute to drainage expenses with the sanction of the Local Government Board. Part II of the Act by Section 15 empowers the Board of Agriculture and Fisheries to enforce in relation to agricultural land any liability to repair walls, banks, sewers, &c., enforceable under Section 15 of the Sewers Act, 1833 (3 & 4 Will. 4, c. 22), and to exercise any powers to prevent agricultural land being injured by flooding or inadequate drainage which are conferred by any general or local Act, or an order having the force of an Act of Parliament. (See Section 14 of the Land Drainage Act, 1847, (10 & 11 Vict., c. 38), which enables the proprietor or occupier of land injured by the neglect of another occupier to cleanse and scour drains, streams, or watercourses lying in or bounding the lands of such occupier, to take measures to remedy or prevent such injury). Under Section 16 the Board, where it is of opinion that any agricultural land is capable of improvement by drainage works, but that the same cannot conveniently be dealt with under Part I. of the Act, and that the expense of executing and maintaining such works will not exceed the increase in the value of the land arising therefrom, may enter in the land and execute such drainage works as appear to it desirable. Before executing any works under this section, the Board must prepare a scheme which is to be open to objections. Any expenses incurred by the Board under this section in the execution of drainage works to an amount not exceeding the maximum declared in the scheme or in maintaining such works, are recoverable by the Board from the several owners of the lands to which the scheme relates, according to the apportionment in the scheme. But any owner may require the sum payable by him to be recoverable by a rate to be made and levied by the Board in like manner, subject to the like provisions, and with the like incidence, as are applicable in the case of a private improvement rate for private improvement expenses incurred by a local authority under the Public Health

Act, 1875. By Section 17 the powers of the Board under this part of the Act may be delegated to a local committee, constituted in the prescribed manner for any area, consisting of one or more counties or county boroughs.

The Small Holdings Colonies (Amendment) Act, 1918, (8 & 9 Geo. 5, c. 26) extends the quantity of land which may be acquired for experimental small holdings under the Small Holdings Colonies Act, 1916 (see the Article on "Contemporary Agricultural Law" in this Journal, Vol. 77, 1916), from 4,500 acres to 45,000 acres in England (excluding Monmouthshire), from 2,000 acres to 20,000 acres in Wales and Monmouthshire, and from 6,000 acres to 60,000 acres as a total limit, and empowers the Board of Agriculture and Fisheries as regards any county to employ the County Council as their agents and vest in them all or any of the powers conferred upon the Board by the Acts of 1916 and 1918, in addition to those vested in such Council by the Small Holdings and Allotments Act, 1908 (8 Edw. 7, c. 36); but it is provided that no portion of this additional land authorised by this Act to be acquired by the Board shall be so acquired except after consultation with the Chairman of the Council of the county in which the land proposed to be acquired is situate or with a Committee of that Council.

The Corn Production (Amendment) Act, 1918 (8 & 9 Geo. 5, c. 36), though short, is of considerable importance. It amends Sub-section 3 of Section 11 of the Corn Production Act, 1917 (7 & 8 Geo. 5, c. 46). That sub-section provided that the powers exercisable by the Board of Agriculture and Fisheries under the Defence of the Realm Regulations, with a view to maintaining the food supply of the country, should cease to operate at the expiration of one year from the passing of the Act (August 21, 1917) or at the termination of the War whichever was earlier, and thereupon the powers given by Part IV. of the Act to enforce proper cultivation of land, which were somewhat less extensive than those conferred by the Regulations, should come into operation. The Corn Production (Amendment) Act, 1918, provides that Part IV. of the Act of 1917 should not come into operation until the termination of the War, which by the Termination of the Present War (Definition) Act, 1918 (8 and 9 Geo. 5, c, 59), is to be a date declared by His Majesty in Council and to be as nearly as may be the date of the exchange or deposit of ratifications of the Treaty or Treaties of Peace, and that meanwhile the powers under the Defence of the Realm Regulations exercisable by the Board with a view to maintaining the food supply of the country shall continue to operate. The Act of 1918 further provides as an amendment to the Act of 1917, (*a*) that if after

August 21, 1918, any person is served under the powers of the Regulations with a notice determining his tenancy of any land or requiring any change in the mode of cultivating or in the use of land in his occupation, and not solely for the purpose of securing that the land shall be cultivated according to the rules of good husbandry, the proviso to Sub-section 1 of Section 9 of the Act of 1917 shall apply, which enables the person aggrieved by the notice to have the question referred to arbitration by an arbitrator agreed upon by the parties, or in default of agreement nominated by the President of the Surveyor's Institution. It is also provided that where any such notice is served on a tenant a copy of the notice shall be served on the landlord who shall have the same right as the tenant of requiring the question to be referred to arbitration. Before the passing of this enactment there was no right of appeal to arbitration either by tenant or landlord in respect of a notice served by the Board or by a County War Agricultural Executive Committee acting on behalf of the Board under the powers of the Defence of the Realm Regulations. The Act of 1918 further gives a like right of appeal to arbitration in cases where notice is served of intention to take possession of land under the powers of the Regulations for the purpose of securing any change in the mode of cultivation or in the use of the land other than the conversion of the land into gardens or allotments, unless the notice is served solely for the purpose of securing that the land shall be cultivated according to the rules of good husbandry. It is to be observed that notices determining a tenancy or requiring any change in the cultivation of land or of intention to take possession of land if served solely for the purpose of securing "that the land shall be cultivated according to the rules of good husbandry," are expressly excepted from the benefits of this amending Act and remain unquestionable by arbitration. The Act further provides that where, before or after the passing of the Act, any notice has been or shall be served, order made, or possession of land taken under the powers continued in operation by this Act, the provisions of Part IV. of the Act of 1917 relating to the determination and recovery of compensation shall apply as if the notice had been served, the order made, or possession taken under the powers conferred by Section 9 of the Act of 1917 which by Sub-section 9 gives a right to compensation for loss suffered by any person interested in land in respect of which any notice is served, order made, or of which possession is taken under the Act if a claim is made for the purpose before the expiration of such period not being less than one year after the exercise of the powers as may be prescribed by the Board.

The Education Act, 1918 (8 & 9 Geo. 5, c. 39), may indirectly in the future have a considerable effect upon Agriculture, raising, as it does, the age for compulsory attendance at elementary schools and providing for compulsory attendance at continuation schools and for the general improvement of education, practical and otherwise, of the children of the country. It does not, however, seem necessary to deal with its provisions in detail here.

The Tithe Act, 1918 (8 & 9 Geo. 5, c. 54), is of some importance. It was passed in consequence of the very great rise in the tithe rent charge which has already taken place and has been caused by the high prices for corn which have prevailed since the War began and more particularly in the last two years, and the still further rise which but for the Act might have been anticipated in the next few years under the present system of ascertaining the annual sum payable for tithe rent charge upon a septennial average of corn prices. Section 1 of the Act fixes the sum payable in respect of any tithe rent charge payable on or before January 1, 1926, as the sum payable in respect of that tithe rent charge as ascertained by the septennial average prices published in January, 1918. That is to say the figure for tithe rent charge in the seven years ending January 1, 1926, is to remain the same as it was for the year 1918, neither rising or falling whatever the prices of corn may be in that period. From and after January 1, 1926, the tithe rent charge is to be based on a fifteen years average of corn prices instead of a seven years average as has hitherto been the case. Section 3 provides for the compulsory redemption of tithe rent charge on the application of the owner of the land charged therewith, unless owing to any exceptional circumstances the Board of Agriculture and Fisheries otherwise directs, notwithstanding that the rent charge exceeds 20*s.* which was the limit for compulsory redemption under the Tithe Acts 1836 to 1891. By Section 4 the consideration money for redemption of a tithe rent charge shall in lieu of the amount authorised or directed by the former Tithe Acts be such sum as may be agreed by the owners of the land and of the rent charge, and in default of such agreement as may be determined by the Board in accordance with the provisions contained in the First Schedule to the Act to be fair compensation for the redemption. An agreement for redemption by a spiritual person entitled in respect of his benefice or cure will, however, not be valid, except with the consent of Queen Anne's Bounty, or in the case of a rent charge affected by the Welsh Church Act, 1914, of the Commissioners of Church Temporalities in Wales. The Schedule provides that the Board are to estimate the annual sum payable in

perpetuity which is equal to the variable rent charge payable under the Tithe Acts and that sum is called the "gross annual value." The compensation of redemption is to be such sum as invested in Government securities will produce a permanent annuity equal to the gross annual value after deducting from that value the average amount paid or payable by the tithe owner in respect of the rent charge for the three years immediately preceding the date of the application to redeem on account of rates and land tax, and such sum not exceeding $2\frac{1}{2}$ per cent. of the gross annual value as in the opinion of the Board represents the necessary cost of collection of the rent charge. The ascertainment of the sum to be paid for redemption of a rent charge for which an application is made on or before January 1, 1921, is simplified by providing that in such case the gross annual value of the rent charge shall be the original commuted amount thereof and the compensation shall be twenty-one times that amount after making such deductions as before-mentioned.

II. Decisions of the Courts.

1. *Labour.*—Questions sometimes arise between employer and workman as to the proper notice to be given to terminate the employment when there has been no express stipulation as to this. When the contract for service is for an indefinite period and is silent regarding the notice which is to be given to terminate it a term must be implied that a reasonable notice should be given. What is a reasonable notice is a question of fact to be decided according to the circumstances of the case. This was so held in *Payzu Lim.* v. *Hannaford* (87 L.J.K.B., 1017; [1918] 2 K.B., 348). In that case the defendant was employed at a weekly wage of 35*s.*, and left the employment without giving one week's notice, in consequence whereof her employers claimed damages. The magistrate before whom the case came held that there was no implied term of the contract of service that any notice should be given, and dismissed the claim. The Divisional Court reversed this decision and referred it back to the magistrate to find what would be a reasonable notice under the circumstances. If a hiring is a weekly hiring it would generally be held that a week's notice is required.

The case of *Manton* v. *Cantwell* (1918, 2 Ir.R., 563; 1918, W.C. and Ins. Report, 265), under the Workmen's Compensation Act, 1906, is of some importance to farmers. In that case a casual labourer was employed by a farmer to thatch the house in which he resided. He fell from the roof and sustained injuries from which he died, and his widow claimed

compensation under the Act from the farmer. It was held that he was not liable, as the deceased was a "casual labourer" and therefore the employer would not be liable for the accident unless the employment was "for the purposes of the employer's trade or business" (see Section 13 of the Act), which the Court considered it was not. The repair of his private residence was not part of the trade or business of the farmer. If the deceased had been employed in repairing an out office, shed, or place for cattle the decision might have been different.

2. *Stock and Crops.* The case of *Coldman* v. *Hill* (1919, 1 K.B., 443) is of importance with reference to contracts of agistment. The plaintiff sued for the loss of two cows delivered by him to the defendant on April 21 under a contract of agistment to graze on some marshes in his occupation for a fixed sum per head the two cows which were in calf. The defendant's stockman, whose duty it was to go round the marshes every day and to count the cattle, found that the plaintiff's cows were missing on June 6, and he reported this to the defendant. On the following day the stockman was told that two men had been seen driving the cows away on June 5, and he reported this also to the defendant. The defendant, acting under a mistaken but unwarranted belief that the plaintiff had himself taken the cows away, did not communicate either with him or the police, and it was not until sometime afterwards that the plaintiff became aware that his two cows were missing, they having in fact been stolen. The County Court Judge held that they were stolen without any default of the defendant, but he gave judgment for the plaintiff on the ground that the defendant was guilty of negligence in not communicating with the plaintiff or with the police on finding that the cows were missing (see note of this case in the article on "Contemporary Agricultural Law," in this Journal, Vol. 78, 1917). The case then went to the King's Bench Divisional Court who reversed the judgment of the County Court, holding that the defendant was not liable to the plaintiff for the loss of the cows because, assuming there was a duty on the part of the defendant to communicate with the plaintiff on notice of the fact that the cows were missing, there was no evidence that their loss was due to the neglect of that duty. The plaintiff then appealed to the Court of Appeal. That Court held that although the defendant was not liable for the actual theft of the cows, which were stolen without any fault on his part, there was a duty on his part to give notice to the plaintiff if the cattle were missing, and not having done so the burden of proof was on him to show that his negligence in this respect did not contribute to the loss. This he had not done. If information had been given at once and prompt search made

the cows, which were heavy in calf and could not have moved far on foot might have been recovered. The judgment of the County Court was therefore restored and the plaintiff became entitled to damages for the loss of his cows.

Theyer v. *Purnell* (88 L.J.K.B., 263; 1918, 2 K.B., 333) was a remarkable case in which damages were claimed by the plaintiff in consequence of the trespass of the defendant's sheep on his land. The sheep strayed on to the plaintiff's land where in the course of a few days they developed scab and in consequence they were detained in a barn and meadow on the plaintiff's land under a notice of detention given under the Sheep Scab Order, 1905, the notice extending also to sheep belonging to the plaintiff, which had been in contact with the trespassing sheep. In an action by the plaintiff to recover damages for the trespass the County Court Judge non-suited the plaintiff on the ground that there was no allegation or proof that the defendant was aware of the diseased condition of his sheep at the date of the trespass. The case then went to the King's Bench Divisional Court who held that it was not necessary in a case of trespass to show that the defendant knew of the condition of the trespassing animals, and he was held liable for the natural consequences of the trespass, that is to say for the expense incurred by the plaintiff in maintaining the defendant's sheep upon his land and also for the damage directly caused to the plaintiff's sheep by the presence of the defendant's sheep under the detention notice.

In *Liverpool Corporation* v. *Coghill & Son, Ltd.* (87 L.J.Ch., 186; [1918] 1 Ch., 307) the plaintiffs were a local sanitary authority who used a considerable quantity of land as a sewage farm, growing thereon rye-grass, turnips, mangolds, potatoes, &c., and occasionally wheat and oats. In 1908 they discovered that the defendants, who were borax manufacturers, were discharging from their works a noxious chemical solution which finding its way on to the farm prejudicially affected the application to the land of the sewage matter and rendered a considerable portion of the farm sterile. The noxious matter was of such a nature that its prejudicial effect would not be perceptible for a number of years. The plaintiffs claimed an injunction to restrain the defendants from discharging any noxious chemical solution on to the plaintiffs' land. The defendants alleged that the effluent had been so discharged for a considerable number of years and relied on the Limitation Act. Mr. Justice Eve held that there was no cause of action until 1908, when the damage became perceptible, and that time did not run against the plaintiffs until that date, and they were therefore entitled to an injunction and an enquiry as to the damages they had sustained.

Stearn v. *Prentice Brothers, Ltd.* (1919, 1 K.B. 394) was a case of injury to a farmer's crops by rats. The defendants carried on business as bone manure manufacturers. A large heap of bones on their premises attracted numbers of rats, which made their way on to a neighbouring farm and ate the corn. It was not proved that the bones kept by the defendants were excessive and unusual in quantity, and it was held that the farmer had no cause of action for damages.

3. *Landlord and Tenant.* There have been some important cases under this branch of the law in the past year.

In *In re Lancaster and Macnamara* (87 L.J.K.B., 1250; [1918] 2 K.B., 472) the tenant held an inn with 86 acres of pastoral land, upon which there were certain barns and other outbuildings, under one contract of tenancy from the landlord. On the determination of his tenancy in April, 1916, he gave notice of a claim for compensation for improvements under Section 1 of the Agricultural Holdings Act, 1908 (8 Edw. 7, c. 28). The landlord resisted this claim on the ground that the premises were not a "holding" within the meaning of Section 48, Sub-section 1, of the Act, which defines a "holding" to which the Act relates as "any parcel of land held by a tenant which is either wholly agricultural or wholly pastoral or in part agricultural and as to the residue pastoral . . . " and contended that the farm was merely an adjunct to the inn so that the holding could not be said to be "wholly pastoral." This contention prevailed with the Court of Appeal who reversed the decision of the County Court Judge, who had decided that the property was a "holding" within the meaning of the Act. Swinfen Eady, M.R., in the course of his judgment said: "In my judgment, when you have a demise comprising substantial business premises in which a business is being conducted as a going concern as well as a farm and lands, such a tenancy is not a holding within the provisions of the Agricultural Holdings Act, 1908." The Court rejected the argument on behalf of the tenant founded on the use of the words "any parcel of land" in Section 48 that any close or part of a close may be treated as a separate holding, although it is not the separate subject of a contract of tenancy. It is obvious that this decision may have a far-reaching effect in cutting down the right to compensation under the Agricultural Holdings Act, 1908, where agricultural land is let with other property not of that nature.

In *Norfolk County Council* v. *Child* (87 L.J.K.B., 1122; [1918] 2 K B, 805) the validity of a notice to quit a farm came into question. The plaintiffs (landlords) served on the defendant (tenant) a notice to quit his farm on October 11, 1917. The notice was enclosed in a letter which was as

follows :—" I am instructed by the Small Holdings Committee to serve upon you the enclosed notice to quit which is intended to terminate your tenancy at Michaelmas unless they see sufficient reason in the meantime to change their opinion." Subsequent correspondence showed that the defendant treated the notice as a valid notice to quit. He however contested its validity in the County Court on the ground that the covering letter incorporated into it a condition or reservation, and therefore that it was not definite or final or unequivocal and was consequently invalid. The County Court Judge decided in favour of the tenant. This decision was reversed by the Court of Appeal, who held that the letter did not introduce into the notice a condition or reservation but merely expressed the right which a landlord always has to waive a notice to quit by arrangement with the tenant.

Another case on the validity of a notice to quit was the Irish case of *Graham* v. *McIlwaine* (1918, 2 Ir. R., 353), where it was held that a purchaser of real estate after payment of the purchase money but before the conveyance to him is executed cannot serve in his own name a notice to quit on a tenant of the lands purchased which will validly determine the tenancy. To serve an effectual notice to quit the purchaser must have obtained the legal title to the land by a proper conveyance.

In the case of *Rex* v. *Rodgers*, *ex parte Hudson* (119 L.T., 718), it was held that under the Increase of Rent and Mortgage Interest (War Restrictions) Act, 1915 (5 & 6 Geo. 5, c. 97), which provides that no order for the recovery of possession of a dwelling house to which the Act applies or for the ejectment of a tenant therefrom shall be made so long as the tenant continues to pay his rent and performs the other conditions of the tenancy except on the ground (*inter alia*) that the premises are reasonably required by the landlord for the occupation of himself " or some other person in his employ." The words " person in his employ " means " a person already in his employ," that is actually in his employ when the order for ejectment is made. In the case under consideration the owner was a farmer who wanted the house for the occupation of a foreman as soon as he could get one. He had a foreman ready to go into possession in October, 1917, when Hudson the tenant should have given up possession, but he had lost the services of the man through inability to find him housing accommodation. As he had no one ready to take possession when the application for an order for ejectment came on he was held not entitled to have an order.

4. *Produce.* Under this heading there are some cases on the sale of milk which are worthy of notice. In *Andrews* v. *Luckin* (87 L.J.K.B., 507) a farmer, under a contract for the

sale of pure milk, delivered at a railway station a churn of genuine milk as it came from the cow. It was not locked in such a way as to render it impossible for any one to tamper with it while it stood at the station or during transit by rail to Hastings, where it was to be delivered to the purchaser. It was sampled on its arrival at Hastings by an Inspector of Nuisances, and on being analysed was found to be deficient in fat and other milk solids. The Justices before whom the farmer was prosecuted were of opinion that as the milk was genuine milk when delivered to the railway company by the farmer he was absolved from liability for any subsequent adulteration. The Divisional Court, however, took a different view and held that the mere fact that the milk was genuine when handed over to the railway company did not relieve the farmer from liability under the Food and Drugs Act, 1875, for selling milk not of the nature, substance and quality demanded by the purchaser. They considered that under the Act an innocent vendor of milk is liable for adulteration without his knowledge or consent during the transit from the local station to the terminus just as he would be liable for an unauthorised act of his servant in adulterating it. In so deciding they followed the case of *Parker* v. *Alder* (68 L.J.Q.B., 7 ; [1899] 1 Q.B., 20).

In *Grigg* v. *Smith* (87 L.J.K.B., 488), on the other hand, the decision was in favour of the farmer. There the farmer was the owner of a cow which had recently calved and he sold a half-pint of milk taken from the morning's milking. The cow was not milked fully, some being left for the calf, but there was no addition to or abstraction from the milk sold except for the necessary purpose of straining impurities. It was however found to be deficient in milk fat to the extent of 13 per cent. On a charge of supplying milk not of the nature, substance and quality demanded by the purchaser, contrary to Section 6 of the Food and Drugs Act, 1875, the Justices found that the deficiency was due to the manner in which the cow had been milked, but that as it had been sold as it came from the cow without abstraction or addition it was of the nature, substance and quality demanded by the purchaser and they dismissed the charge. It was held by the Divisional Court following *Hunt* v. *Richardson* (85 L.J.K.B., 1360 ; [1916] 2 K.B., 446), which is noted in the article on "Contemporary Agricultural Law" in Vol. 77 of this Journal, that the decision of the Justices was right.

Williams v. *Rees* (87 L.J.K.B., 639) was a similar case where a farmer's daughter acting on his behalf sold a pint of new milk which was found on analysis to be deficient in butter fat to the extent of 28 per cent. The cow that produced the

milk was in good condition and apparently healthy but had only some exceptionally poor pasture to graze on, the farmer's best land being reserved for hay, and she was not given any meal or foodstuffs to supplement the grazing. It was held that no offence had been committed under the Sale of Food and Drugs Act, 1875, as the milk, though deficient in fat, was sold as it came from the cow. These decisions make it clear that a farmer selling genuine and unadulterated milk as it comes from the cow, though it may from natural causes contain less than the amount of butter fat required by the Sale of Milk Regulations, 1901, commits no offence.

In *Whyatt* v. *Erlam* (16 L.G.R., 505; 119 L.T., 86) the question was whether a certain farmer had infringed the Milk (Prices) Order, 1917, under the Defence of the Realm Regulations. The farmer, Ann Erlam, sold milk wholesale to a milk dealer and delivered it by road at his place of business, which was about one and a half or two miles from the farm, every morning, the afternoon's supply being fetched by the dealer. She charged 3*s.* 6*d.* per week for the cost of carriage over and above the price of milk as fixed by the Order. It was held by the Divisional Court that the farmer had committed an offence against the Order, as the maximum price fixed is the absolute maximum which the wholesale seller is entitled to charge when he delivers the milk at the buyer's premises. It is illegal to add any sum whatever to the maximum price on account of delivery except in the case where there is railway transport, which is at the seller's option, when the cost actually incurred for such transport may be charged.

Cook v. *Dunn* (87 L.J.K.B., 364) was another case relating to maximum prices. Dunn was a builder by trade who occupied an allotment of half an acre and a small garden of about one rood where he grew potatoes. He consigned about eight stone of potatoes, the produce of his land, to auctioneers, who sold to persons other than retailers at 1*s.* 10½*d.* per stone, being above the maximum price fixed by Article 2 of the Potatoes 1916 Main Crop Prices Order, No 2, 1917, in the case of a sale of potatoes "by or on behalf of the grower thereof to any person other than a retailer." The Justices held that Dunn was not the "grower" of the potatoes within the Order and dismissed the information. The Divisional Court held that the Justices ought to have convicted, since the article was not intended to apply only to persons whose sole or substantial business consisted in the cultivation of potatoes.

5. *Miscellaneous.* *Dennis* v. *Good* (35 Times L.R., 93) was a case relating to public footpaths which crossed a grass field in the occupation of Dennis & Sons, Ltd. They were directed by the County War Agricultural Executive Committee, acting

under Regulation 2 M of the Defence of the Realm Regulations, to plough up the field. This they did, ploughing up with the field the footpaths which crossed it, and using for the purpose ploughs drawn by steam power. They were convicted by the Justices under the Highway Act, 1835 (5 & 6 Will. 4, c. 50), for destroying the footpaths. They appealed to the Divisional Court but their appeal was unsuccessful, it being held that a public footpath was a highway within the meaning of the Act and that the notice from the Committee did not justify them in destroying it. Mr. Justice Avory said that even if the appellants could show that it was impossible for them to comply with the notice without ploughing up the footpaths they would not be entitled to do so, because the Committee had no power to require them to cultivate a highway.

In *Inland Revenue Commissioners* v. *Ransom & Son, Ltd.* (1918, 2 K.B., 709), the question arose as to what the term "husbandry" means. The Finance (No. 2) Act, 1915, (5 & 6 Geo. 5, c. 59), imposes an excess profits duty on certain trades and businesses but excepts (*inter alia*) "husbandry" from the burden of this duty. The respondents were a limited company carrying on business as manufacturing chemists and growers of medicinal and other herbs. They owned a factory where the manufacture and distillation of herbs were carried on, and also occupied a farm in which they grew herbs for treatment in the factory. Mr. Justice Sankey held that the evidence before the General Income Tax Commissioners was sufficient to justify them in finding that the tilling of the soil for the production of medicinal herbs was "husbandry" within the meaning of the Act, and that as it was possible to separate the business of husbandry carried on by the respondents from their other business, there was nothing in law to prevent this being done, and therefore they were rightly exempted from excess profits duty in respect of the husbandry business.

Minister of Munitions v. *Chamberlayne* (87 L.J.K.B., 1266; [1918] 2 K.B., 758) was a case of the compulsory acquisition of land under the Defence of the Realm (Acquisition of Land) Act, 1916, (6 & 7 Geo. 5, c. 63), which enacted, by Section 13, that nothing in the Act should authorise the acquisition otherwise than by agreement of any land which forms part of any park, garden, or pleasure ground, or of the home farm attached to, and usually occupied with the mansion house, but by Section 15, Sub-section 1 (*b*) provided that "where before the passing of this Act there have been erected in any park, garden, pleasure ground, or farm as above mentioned, any buildings for the manufacture of munitions of war, the [Railway and

Canal] Commission may by order authorise the compulsory acquisition of the park, garden, pleasure ground, or farm, or any part thereof, where they are satisfied that it is of national importance that it should be acquired, so, however, that if the owner so requires the whole of such property, including the mansion house, if any, shall be acquired. . . . ." Before the date of the passing of the Act the Minister of Munitions had erected a large factory for the manufacture of munitions on land contiguous to the respondent's park and had commenced to build an extension of the factory in that part of the respondent's park which was adjacent thereto. It was held that buildings for the manufacture of munitions of war have been "erected" within the meaning of the Section if there is on the land a substantial though not a complete structure, and that therefore the case came within the above quoted proviso, and the Railway and Canal Commission had power to authorise the compulsory requisition not only of the park but also of the mansion house and other buildings thereon.

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THE WORK OF THE AGRICULTURAL WAGES BOARD IN 1918.

A PREVIOUS note on this subject in the *Journal* (Vol. 78, pp. 138–42) dealt with the constitution, organisation and powers of the Agricultural Wages Board and the District Wages Committees. When that was written, in the early part of 1918, the Board had not begun its essential work of fixing rates of wages. The Board first met in the early part of December, and until the end of March the meetings were mainly devoted to the establishment of the District Wages Committees, and the appointment of Committees of the Board itself which were established to deal with complicated subjects requiring detailed consideration which would arise in the determination of rates of wages. Amongst such subjects were "cottage rents" and allowances and perquisites, legally known as "benefits and advantages."

About the end of March, however, the first recommendation from a District Committee—that from Norfolk—was received. The farm workers in this county had a stronger and better organised industrial association than those of any other county: and in this case the union had existed for a sufficient length of time to have developed the spirit of industrial association.

Consequently it became necessary for the Board to take immediate action, and they at once proceeded to propose minimum rates of wages for agricultural workmen in Norfolk.

On looking back, it is not surprising that the Board was spurred to action by the attitude of the workers. The average rate of wages of all classes of farm workers throughout England in January, 1918, was less than 70 per cent higher than in 1914, while prices both of the requirements of farm workers' families and of farmers' sale produce showed a much greater increase. For instance, the average prices of farm produce, as prepared by the Board of Agriculture and Fisheries, show an increase between 1913 and 1917 of over 90 per cent.[1]

The minimum rates of wages fixed for male workmen in Norfolk came into force on the 20th of May, 1918. As these rates more or less set an example for the eastern, midland, southern and south western counties of England, the details may be quoted. The year was divided in two periods, summer and winter, of about 34 and 18 weeks respectively ; the summer period being that between the first Monday in March and the last Sunday in October. It was provided that the wages payable should not be less than wages at the minimum rate of 30*s.* per week, of 54 hours in summer and 48 hours in winter, exclusive of meal times. These wages were payable to male workmen of 18 years of age and over.

Recommendations from other District Wages Committees, mostly in the eastern counties, were received during April ; and from then onwards the receipt of recommendations was rapid and continuous. During the early summer the Board was continuously issuing proposals to fix rates of wages for different districts (the districts being mostly county areas), and issuing orders, fixing rates as the notices expired. But it was not until the end of October that a basic minimum rate had been determined for each district. The earliest order fixing rates for special classes (horsemen, cattlemen, shepherds, &c.) was that issued for Norfolk, which came into force on the 29th of July. It was not until the end of 1918, however, that the determination of rates of wages for special classes in the districts for which such rates have been fixed, was completed. For some districts no special rates for special classes have been determined, and in these cases all workers, whatever their occupations, are subject to the same minimum and overtime rates. In the summer of 1918 the Board had also to consider the determination of minimum rates of wages for overtime in respect of adult male workmen, and of such rates for boys and youths. Orders in respect of such rates were eventually published during the year. With respect to wages for female

[1] See Cd. 7487, 1914 ; and Cd. 9163, 1918.

workers a general order determining minimum rates, applying to nearly the whole country, and an order applying to Northumberland came into force on October 21st, 1918.

The minimum rates of wages for different classes of workers which were in force on March 1, 1919, are given in the Appendix to this note. But a summary of the chief points may be given. Dealing first with ordinary labourers, or day men : There are 38 counties (including Furness District of Lancashire) in which the full minimum rate of wages is payable at the age of 18 years, and 15 counties in which it is payable at the age of 21 years. In the latter 15 counties there are special rates for workers aged 18 to 20 years, inclusive.[1] In the 38 counties in which the age at which the minimum rate is payable at the age of 18 years the rates in force are as follows :—

Rate s.	d.	Number of Counties in which Rate is Payable
30	0	21
31	0	7
31	6	2
33	0	1
35	0	6
36	0	1

And in the 15 counties in which the minimum rate is payable at 21 years of age the rates are :—

Rate		Number of Counties
31	0	3
32	0	4
33	0	1
34	0	2
35	0	1
36	0	2
36	6	2

Combining the two groups, and neglecting the difference in the age-level at which the minimum rate is payable, the rates and the number of times which they occur are as follows :—

Rate s.	d.	Number of Counties in which Payable	Rate s.	d.	Number of Counties in which payable
30	0	21	34	0	2
31	0	10	35	0	7
31	6	2	36	0	3
32	0	4	36	6	2
33	0	2			

In the districts in which the minimum rate is payable at 18 years the weekly number of hours is 54 in summer, and 48 in winter, with the exception of 7 districts. These hours are also most frequent in the districts in which the minimum rate is payable at 21 years of age. But the orders issued by the

[1] The area under the authority of the Board is the whole of England and Wales, and the Welsh districts are included in these figures. There are 39 "District Wages Committees" in England and Wales, and consequently 39 "Districts"; but the Tables of Rates of wages in the Appendix specify the rates by counties, with two rates for Lancashire, viz., Lancashire, except the Furness District, and the Furness District.

Agricultural Wages Board provide that when by mutual agreement between employer and worker the hours of work of a whole-time workman employed by the week or for a longer period are less than those specified in the orders, the full weekly wage shall nevertheless be payable.

The minimum rates of wages for overtime for ordinary workers which occur most frequently is $8\frac{1}{2}d.$ per hour on weekdays and $10d.$ per hour on Sundays. Throughout the whole of the districts the variation is between $8\frac{1}{2}d.$ and $10d.$ per hour on weekdays, and $9d.$ and $11\frac{1}{2}d.$ per hour on Sundays.

The minimum rates of wages fixed for special classes do not lend themselves to such simple summarising as those fixed for ordinary labourers. However, it may be said that a single rate applies to all skilled men (horsemen, cowmen, shepherds or such descriptions as they are known by) in the special classes in 25 districts. In other districts more than one rate has been fixed, and the special classes are divided under two or more descriptions of workmen. In some counties, as in Oxfordshire, no special weekly rates have been fixed for men of the skilled classes. For men over 18 or 21 years of age, as the case may be, the minimum rate of wages fixed for male workmen in the special classes vary between $33s.$ and $43s.$ per week. The lower rates apply, as in Berkshire, to under or second horsemen and cowmen, and the lowest rates for skilled men of full age in charge, as head horsemen or head cowmen, is $35s.$ per week. The hours of work of men of the special classes for which the minimum rates are payable are the hours of employment, whether on weekdays or on Sundays, customary in the areas of the separate District Wages Committee, except in the cases of some Welsh counties. The overtime rate per hour for men of full age (18 or 21 years) varies between $8\frac{1}{2}d.$ and $10d.$ on weekdays and $8\frac{1}{2}d.$ and $1s.$ on Sundays.

For male workers under 19 years of age the following are the highest and lowest minimum rates of wages, and those which most frequently occur. It should be remembered that the total number of counties (including the Furness district of Lancashire) for which rates have been fixed is 53.

Age	Lowest and highest minimum rates		Predominant minimum rate	No. of Districts in which predominant rate is payable
	Lowest	Highest		
	s. d.	*s. d.*	*s. d.*	
17 years	25 0	31 0	26 0	37
16 „	20 0	26 0	22 0	37
15 „	18 0	21 0	18 0	44
14 „	14 0	18 0	14 0	46
Under 14 years . .	10 0	12 0	10 0	50

With the exception of eight counties, the hours of work for boys and youths of these ages on which the rates are payable are 54 and 48 per week in summer and winter respectively. The rates for overtime, which most frequently occur, are as follows :—

Age	Rates for Overtime	
	Weekdays	Sundays
	d.	*d.*
17 years	7	8½
16 „	6	7½
15 „	5	6
14 „	4	4½
Under 14 years	3	3½

It should be stated, however, that all rates for male workmen under 18 years not included in the special classes, of all ages, are subject to a reduction of 20 per cent. during the first two months of the worker's employment in agriculture, except in the districts of Merioneth and Montgomery.

The minimum rates of wages for female workers have been fixed on an hourly basis, except in the case of Northumberland. The most general minimum rates per hour for female workers in district wages areas in England and Wales are :—

Age	Minimum	Overtime rates	
	Rate per hour	Weekdays	Sundays
	d.	*d.*	*d.*
18 years and over	5	6	7½
17 years	4½	5½	7
16 „	4	5	6
15 „	3½	4½	5
14 „	3	4	4½
Under 14 years	2½	3	4

In Northumberland the minimum weekly rate for female workers, 18 years of age and over, is 22*s.* 6*d.*

A special minimum rate of wages for market gardeners in Essex has also been fixed.

During the Spring of 1918 the question of providing for a weekly half-holiday for farm workers came before the Agricultural Wages Board. The powers of the Board do not provide for the regulation of the hours of labour as such, but they are sufficient to provide for the regulation of payment under different circumstances, and to enable the Board to fix differential rates of payment. Consequently it was proposed to provide that where the contract of employment of a workman

did not provide that the working hours in one day of the week (not being Sunday) shall be $6\frac{1}{2}$ hours or less, a differential rate of overtime should apply in lieu of the minimum rates. It was eventually resolved, however, that the publication of this proposal should be postponed until three months after the cessation of hostilities. The Order providing for a differential rate for overtime for "all employment in excess of $6\frac{1}{2}$ hours on a Saturday, or on such other day (not being Sunday) in every week as may be agreed between the employer and the worker" came into force on March 6, 1919.[1]

One of the most important Orders issued by the Board was that defining "benefits and advantages" for the purpose of deducting the value of any allowance in kind from the minimum rates of cash wages as determined for the different areas. This Order came into force on September 6, 1918. The benefits and advantages for which such deductions may be made are :—

(1) Milk, including skimmed or separated milk.

(2) Potatoes.

(3) Lodging, except in any case in which the District Wages Committee shall determine that the lodging provided is so defective as to be injurious to health.

(4) Board, including any meals but not including intoxicating drink.

(5) A cottage, including any garden hitherto given or let with the cottage, except where the cottage is one in regard to which the medical officer of health has reported that it is in a state so dangerous or injurious to health as to be unfit for human habitation.

The values at which these allowances are to be reckoned as part payment of minimum rate of wages in lieu of payment in cash are, in the case of milk and potatoes, "current producer's wholesale price" : in the case of board or lodging "such value as may be determined by the District Wages Committee" ; and in the case of a non-defective cottage, "3*s*. per week, less the amount of any rent or rates which may be paid by the occupier." The determination of local "current producer's wholesale prices," together with the determination of the value of board or lodging, and certain powers with respect to cottages, was delegated to the District Wages Committee, subject to revision by the Agricultural Wages Board. A later Order has provided that in case a District Wages Committee fails to ascertain or determine the respective value of benefits and advantages the Board may determine such values as may appear to them to be reasonable. All values so determined are subject to periodical revision. No deductions from the minimum rates of cash

[1] For illustrations of the effect of this Order see *Wages Board Gazette*, Vol. I. No. xii. (February 1, 1919).

wages can be made except on account of the benefits and advantages as defined by the Board.

Provision is made whereby a District Wages Committee may on the application of a worker certify a cottage as defective in respect of accommodation, want of repair, of sanitation (including water supply), and determine a lesser amount than 3*s.* as the maximum value at which it may be reckoned in part payment of wages.

The respective values of the specified "allowances" have now been determined for each county; and full details have been published by the Agricultural Wages Board. The value of milk, on the basis given above, in all areas is, skimmed 8*d.* per gallon, and new 6½*d.* per quart, or the wholesale price fixed for any particular district by the Local Food Control Committee for such district, whichever is the lesser. The value of potatoes, in the districts in which they are recognised as benefits or advantages, varies between 5*l.* 10*s.* and 7*l.* 10*s.* per ton for potatoes of the *second* grade, and for potatoes of the *first* grade the value is 10*s.* per ton higher. The value of board and lodging is determined according to the age of the worker, and the value of board alone according to the various meals and the age of the worker. But for males of 17 years and over (except in Surrey, where the age varies) it is 18*s.* per week in 21 districts, 17*s.* 6*d.* per week in 7 districts, and 17*s.* and 16*s.* in one district each. All these rates are in respect of English districts. In Wales the values of full board and lodging for a seven-day week vary between 12*s.* and 15*s.* 6*d.* In Glamorgan and Monmouth, for which the higher values have been determined, the age is varied. For females 17 years of age and over, the value of full board and lodging has been determined at rates varying between 12*s.* 6*d.* and 13*s.* in England, and at 11*s.* in Wales. Full details of these rates may be seen in a publication of the Agricultural Wages Board (A.W. 311).

Some special orders have been issued fixing the value of non-defective cottages in Northamptonshire and Herefordshire, and in parts of Buckinghamshire and Somerset, at less than 3*s.*

No action has yet been taken in regard to the determination of rates of wages for piecework.

The power to grant permits of exemption to non-ablebodied workers was delegated by the Board to the District Wages Committees, subject to certain conditions as to review by the Wages Board. During the period of hostilities and shortage of labour the number of applications for permits was not very large, compared to what might have been expected. This may have been due, to some extent, to unwillingness on the part of employers to give cause for any feeling of resentment to workers during the labour shortage, but it may also have been due to

some idea that in certain cases the provisions of the Wages Board Orders would not be rigidly enforced. Hence there has been a certain amount of negligence by employers on this matter.

Until the end of last year the enforcement of the Orders of the Board was, more or less, accomplished by correspondence and negotiations. A staff of Inspectors has, however, now been appointed, a number of prosecutions have been undertaken, and several convictions have been recorded. It is probable that any negligence in regard to applications for permits of exemption will disappear as a result of these actions.

In addition to its essential function of fixing minimum rates of wages, the Agricultural Wages Board has been the agent for the accomplishment of several useful objects. The inquiry into wages and conditions of employment in agriculture, mentioned in the *Journal* last year, has been completed. A survey of conditions in each county in England and Wales was made and the individual reports on these surveys have been published as a command paper (Cd. 25, 1919), together with a general report on the whole survey (Cd. 24, 1919). In March, 1919, the Agricultural Wages Board appointed a Committee "to enquire into the financial results of the occupation of agricultural land and market gardens, in view of the cost of production under existing conditions, and the present controlled prices of farm and garden produce, and also to enquire into the cost of living as affecting workers in rural districts." This Committee has collected a considerable body of information relating to the cost of living of rural workers, but the results obtained with regard to the financial results of the occupation of land were disappointing, to say the least. The report of this Committee has been published as a command paper (Cd. 76, 1919). Also, an off-shoot of the Agricultural Wages Board, a discussion club known as the Agricultural Club, under the presidency of Sir Henry Rew, has produced several interesting and useful papers on matters of interest to agriculturists; and another off-shoot, the Village Clubs Association is trying to direct attention to the provision of means of recreation in rural areas.

It must be added that the Board now issues a fortnightly publication, the *Wages Board Gazette*, which contains news and notes on the work of the Board. This is edited, and may be obtained at, the offices of the Board (80 Pall Mall, S.W. 1).

Some criticisms of the actions of the Board might not be out of place in a review of this kind, but this note has already reached such a length as to preclude the possibility of dealing adequately with criticisms. At the same time, it is recognised that criticism is necessary to the fulfilment of its functions by a public body; and that well informed criticism should always

be welcomed. This note, however, cannot pretend to be more than a sketch of the history of an institution which now occupies an important position in the organisation of the farming industry.

It may be added that the personnel of the Board remains the same as last year, except for a change in the representation of women on the Workers' side. On the other hand, there have been numerous changes in the representation of both sides, as in the appointed members, on the District Committees.

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APPENDIX.

Minimum Rates of Wages in Force 1st March, 1918.

MALE WORKERS.

Notes to Tables I., II., III., and IV.

1. The minimum rates set out in Tables I., II., III., and IV. below apply to all male workmen of the age groups specified, in the various counties, except in the case of special classes of workers for whom special minimum rates have been fixed as set out in Table V. below.

2 The minimum weekly wages set out in Column (2) of Tables I., II., III., and IV. are the wages payable in respect of the number of hours per week (excluding Sunday work) in Summer and in Winter respectively shown in Column (3).

3. The Sunday overtime rate is payable in respect of all employment on a Sunday. The weekday overtime rate is payable as regards all counties, in respect of (*a*) all employment in excess of 6½ hours on a Saturday, or on such other day (not being Sunday) in every week, as may be agreed between the employer and the worker, except time spent by stockmen of any class on such day in connection with the feeding and cleaning of stock; and as regards all counties, except Bucks and Cheshire, in respect of (*b*) all employment in any week (excluding Sunday) in excess of the number of hours in Summer and in Winter respectively (as shown in Column (3)) which forms the basis for the weekly wage, irrespective of whether or not such employment is in connection with the feeding and cleaning of stock. In the case of Bucks and Cheshire, the employment to which the weekday overtime rates relates is defined by reference to the number of hours of work on each day, and the actual Orders should be consulted for the detailed provisions.

4. The Orders provide that when by mutual agreement between employer and worker the hours of work of a whole-time workman employed by the week or longer, are less than the hours specified in Column (3), the full weekly wage as shown in Column (2) shall nevertheless be payable.

5. Meal times are not included in the hours of work for the purpose of calculating the wage payable under the Board's Orders, but any time during which a worker, by reason of weather conditions, is prevented by his employer from working although he is present at the place of employment and is ready for work, is to be reckoned in the hours of work for the purpose of payment of the minimum wage.

6. The minimum rates and overtime rates for male workmen of under 18 years of age, as set out in Table 4, are subject to a deduction of 20 per cent. during the first two months of the workers' employment in agriculture except as regards Merioneth and Montgomery.

7. "Summer" is the period from the first Monday in March to the last Sunday in October; "Winter" is the remaining period of the year.

TABLE I.—*Male Workers of* 21 *years and over.*

County	Minimum weekly wage	Number of hours per week for minimum wage		Overtime rate per hour	
(1)	(2)	(3)		(4)	
		Summer	Winter	Weekdays	Sundays
	s. *d.*			*s.* *d.*	*s.* *d.*
Cardigan	31 0	54	48	0 8½	0 10
Carmarthen	31 0	54	48	0 8½	0 10
Durham	36 0	54	48	0 10	1 0
Essex	32 0	54	48	0 9	0 11
Glamorgan	36 6	57	49½	0 9½	0 11½
Hertfordshire	32 0	54	48	0 9	0 11
Lincolnshire	34 0	54	48	0 9½	0 11½
Middlesex	34 0	54	48	0 9	0 11
Monmouth	36 6	57	49½	0 9½	0 11½
Northumberland	36 0	54	48	0 10	1 0
Pembroke	31 0	54	48	0 8½	0 10
Shropshire	33 0	57	54	0 9	0 10
Staffordshire	35 0	57	57	0 9	0 11
Surrey	33 0	54	48	0 9	0 11
Sussex	32 0	54	48	0 9	0 11

TABLE II.—*Male Workers of* 18 *years and less than* 21 *years.*

County	Age	Minimum weekly wage	Number of hours per week for minimum wage		Overtime rates per hour	
(1)		(2)	(3)		(4)	
			Summer	Winter	Weekdays	Sundays
		s. *d.*			*s.* *d.*	*s.* *d.*
Cardigan	18—21	30 0	54	48	0 8½	0 10
Carmarthen	18—21	30 0	54	48	0 8½	0 10
Durham	18—19	33 0	54	48	0 9	0 11
	19—21	36 0	54	48	0 10	1 0
Essex	18—21	30 0	54	48	0 8½	0 10
Glamorgan	18—19	32 0	57	49½	0 8½	0 10
	19—21	35 0	57	49½	0 9	0 11
Hertfordshire	18—21	31 0	54	48	0 8½	0 10
Lincolnshire	18—21	30 0	54	48	0 8½	0 10
Middlesex	18—21	31 0	54	48	0 8½	0 10
Monmouth	18—19	32 0	57	49½	0 8½	0 10
	19—21	35 0	57	49½	0 9	0 11
Northumberland	18—19	33 0	54	48	0 9	0 11
	19—21	36 0	54	48	0 10	1 0
Pembroke	18—21	30 0	54	48	0 8½	0 10
Shropshire	18—21	31 0	57	54	0 9	0 9
Staffordshire	18—20	32 0	57	57	0 8½	0 10
	20—21	34 0	57	57	0 9	0 10½
Surrey	18—21	31 0	54	48	0 8½	0 10
Sussex	18—21	30 0	54	48	0 8½	0 10

TABLE III.—*Male Workers of* 18 *years and over (not included above).*

County	Minimum weekly wage	Number of hours per week for minimum wage		Overtime rates per hour	
(1)	(2)	(3)		(4)	
		Summer	Winter	Weekdays	Sundays
	s. *d.*			*s.* *d.*	*s.* *d.*
Anglesey	31 6	56	51	0 8½	0 10
Bedfordshire	30 0	54	48	0 8½	0 10
Berkshire	30 0	54	48	0 8½	0 10
Brecon	30 0	54	48	0 8½	0 10
Buckinghamshire	30 0	54	48	0 9	0 9
Cambridgeshire	30 0	54	48	0 8½	0 10
Carnarvonshire	31 6	56	51	0 8½	0 10
Cheshire	36 0	60	60	0 9	0 10
Cornwall	31 0	54	48	0 9	0 10
Cumberland	35 0	54	48	0 10	1 0
Denbigh	30 0	54	48	0 8½	0 10
Derbyshire	31 0	54	48	0 9	0 9
Devon	31 0	54	48	0 8½	0 10
Dorset	30 0	54	48	0 8½	0 10
Flint	30 0	54	48	0 8½	0 10
Furness District of Lancs.	35 0	54	48	0 10	1 0
Gloucestershire	30 0	54	48	0 8½	0 10
Hampshire	31 0	54	48	0 8½	0 10
Herefordshire	31 0	56	48	0 8½	0 10
Huntingdonshire	30 0	54	48	0 8½	0 10
Kent	33 0	54	48	0 9	0 11
Lancashire (except Furness District)	35 0	55½	55½	0 9½	0 11½
Leicestershire	31 0	54	48	8½*d.* and 9*d.*[1]	0 9
Merioneth	30 0	54	48	0 8½	0 10
Montgomery	30 0	54	48	0 8½	0 10
Norfolk	30 0	54	48	0 8½	0 10
Northamptonshire	30 0	54	48	0 8½	0 10
Nottinghamshire	35 0	60	54	0 9	0 10
Oxfordshire	30 0	52	52	0 8½	0 10
Radnor	30 0	54	48	0 8½	0 10
Rutland	31 0	54	48	8½*d.* and 9*d.*[1]	0 9
Somerset	30 0	54	48	0 8½	0 10
Suffolk	30 0	54	48	0 8½	0 10
Warwickshire	30 0	54	48	0 8½	0 10
Westmorland	35 0	54	48	0 10	1 0
Wiltshire	30 0	54	48	0 8½	0 10
Worcestershire	30 0	54	48	0 8½	0 10
Yorkshire	35 0	54	51	0 9½	0 11½

[1] 8½*d.* per hour for 6 hours overtime in any week; 9*d.* per hour for all overtime in excess of 6 hours.

TABLE IV.—(*a*) *Male Workers of less than 18 years of age.*

County	(a) Minimum weekly wage at ages:										Number of hours per week for minimum wage	
(1)	(2)										(3)	
	17 to 18		16 to 17		15 to 16		14 to 15		Under 14		Summer	Winter
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d*		
Anglesey	26	0	22	0	18	0	14	0	12	0	56	51
Bedfordshire	26	0	22	0	18	0	14	0	10	0	54	48
Berkshire	26	0	22	0	18	0	14	0	10	0	54	48
Brecon	25	0	20	0	18	0	14	0	10	0	54	48
Buckinghamshire	26	0	22	0	18	0	14	0	10	0	54	48
Cambridgeshire	26	0	22	0	18	0	14	0	10	0	54	48
Cardiganshire	26	0	22	0	18	0	14	0	10	0	54	48
Carmarthenshire	26	0	22	0	18	0	14	0	10	0	54	48
Carnarvonshire	26	0	22	0	18	0	14	0	12	0	56	51
Cheshire	31	0	26	0	21	0	16	0	11	0	60	60
Cornwall	26	0	22	0	18	0	14	0	10	0	54	48
Cumberland	30	0	25	0	20	0	15	0	10	0	54	48
Denbigh	26	0	22	0	18	0	14	0	10	0	54	48
Derbyshire	26	0	22	0	18	0	14	0	10	0	54	48
Devon	26	0	22	0	18	0	14	0	10	0	54	48
Dorset	26	0	22	0	18	0	14	0	10	0	54	48
Durham	28	0	23	0	18	0	14	0	10	0	54	48
Essex	26	0	22	0	18	0	14	0	10	0	54	48
Flint	26	0	22	0	18	0	14	0	10	0	54	48
Furness District of Lancashire	30	0	25	0	20	0	15	0	10	0	54	48
Glamorgan	28	6	24	6	21	0	18	0	10	0	57	49½
Gloucestershire	26	0	22	0	18	0	14	0	10	0	54	48
Hampshire	26	0	22	0	18	0	14	0	10	0	54	48
Herefordshire	26	0	22	0	18	0	14	0	10	0	56	48
Hertfordshire	26	0	22	0	18	0	14	0	10	0	54	48
Huntingdonshire	26	0	22	0	18	0	14	0	10	0	54	48
Kent	28	0	23	0	18	0	14	0	10	0	54	48
Lancashire (except Furness District)	30	0	25	0	20	0	15	0	10	0	55½	55½
Leicestershire	26	0	22	0	18	0	14	0	10	0	54	48
Lincolnshire	26	0	22	0	18	0	14	0	10	0	54	48
Merioneth	25	0	20	0	18	0	14	0	10	0	54	48
Middlesex	26	0	22	0	18	0	14	0	10	0	54	48
Monmouthshire	28	6	24	6	21	0	18	0	10	0	57	49½
Montgomery	25	0	20	0	18	0	14	0	10	0	54	48
Norfolk	26	0	22	0	18	0	14	0	10	0	54	48
Northants	26	0	22	0	18	0	14	0	10	0	54	48
Northumberland	28	0	23	0	18	0	14	0	10	0	54	48
Nottinghamshire	30	0	25	0	20	0	15	0	10	0	60	54
Oxfordshire	26	0	22	0	18	0	14	0	10	0	52	52
Pembrokeshire	26	0	22	0	18	0	14	0	10	0	54	48
Radnor	25	0	20	0	18	0	14	0	10	0	54	48
Rutland	26	0	22	0	18	0	14	0	10	0	54	48
Shropshire	26	0	22	0	18	0	14	0	10	0	57	54
Somerset	26	0	22	0	18	0	14	0	10	0	54	48
Staffordshire	26	0	22	0	18	0	14	0	10	0	57	57
Suffolk	26	0	22	0	18	0	14	0	10	0	54	48
Surrey	26	0	22	0	18	0	14	0	10	0	54	48
Sussex	26	0	22	0	18	0	14	0	10	0	54	48
Warwickshire	26	0	22	0	18	0	14	0	10	0	54	48
Westmorland	30	0	25	0	20	0	15	0	10	0	54	48
Wiltshire	26	0	22	0	18	0	14	0	10	0	54	48
Worcestershire	26	0	22	0	18	0	14	0	10	0	54	48
Yorkshire	30	0	25	0	20	0	15	0	10	0	54	51

TABLE IV.—(*b*) *Male Workers of less than 18 years of age—(continued).*

County	(b) Overtime rates per hour									
	17 to 18		16 to 17		15 to 16		14 to 15		Under 14	
	W.[1]	S.[2]	W.[1]	S.[2]	W.[1]	S.[2]	W.[1]	S.[2]	W.[1]	S.[2]
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
Anglesey	7	8½	6	7	5	6	4	4½	3	4
Bedfordshire	7	8½	6	7½	5	6	4	4½	3	3½
Berkshire	7	8½	6	7½	5	6	4	4½	3	3½
Brecon	7	8½	5½	6½	5	6	4	4½	3	3½
Buckinghamshire	7	8½	6	7½	5	6	4	4½	3	3½
Cambridgeshire	7	8½	6	7½	5	6	4	4½	3	3½
Cardiganshire	7	8½	6	7½	5	6	4	4½	3	3½
Carmarthenshire	7	8½	6	7½	5	6	4	4½	3	3½
Carnarvonshire	7	8½	6	7	5	6	4	4½	3	4
Cheshire	8	9½	6½	8	5	6½	4	5	3	3½
Cornwall	7	8½	6	7½	5	6	4	4½	3	3½
Cumberland	8½	10	7	8½	5½	6½	4	5	3	3½
Denbigh	7	8½	6	7½	5	6	4	4½	3	3½
Derbyshire	7	8½	6	7½	5	6	4	4½	3	3½
Devon	7	8½	6	7½	5	6	4	4½	3	3½
Dorset	7	8½	6	7½	5	6	4	4½	3	3½
Durham	8	9½	6½	7½	5	6	4	4½	3	3½
Essex	7	8½	6	7½	5	6	4	4½	3	3½
Flint	7	8½	6	7½	5	6	4	4½	3	3½
Furness District of Lancashire	8½	10	7	8½	5½	6½	4	5	3	3½
Glamorgan	7½	9	6½	7½	5½	6½	4½	5½	2½	3
Gloucestershire	7	8½	6	7½	5	6	4	4½	3	3½
Hampshire	7	8½	6	7½	5	6	4	4½	3	3½
Herefordshire	7	8½	6	7	5	6	4	4½	2½	3
Hertfordshire	7	8½	6	7½	5	6	4	4½	3	3½
Huntingdonshire	7	8½	6	7½	5	6	4	4½	3	3½
Kent	8	9½	6½	7½	5	6	4	4½	3	3½
Lancashire (except Furness District)	8	9½	7	8	5½	6½	4	5	2½	3
Leicestershire	7	8½	6	7½	5	6	4	4½	3	3½
Lincolnshire	7	8½	6	7½	5	6	4	4½	3	3½
Merioneth	7	8½	5½	6½	5	6	4	4½	3	3½
Middlesex	7	8½	6	7½	5	6	4	4½	3	3½
Monmouthshire	7½	9	6½	7½	5½	6½	4½	5½	2½	3
Montgomery	7	8½	5½	6½	5	6	4	4½	3	3½
Norfolk	7	8½	6	7½	5	6	4	4½	3	3½
Northants	7	8½	6	7½	5	6	4	4½	3	3½
Northumberland	8	9½	6½	7½	5	6	4	4½	3	3½
Nottinghamshire	7½	9	6½	7½	5	6	4	4½	2½	3
Oxfordshire	7	8½	6	7½	5	6	4	4½	3	3½
Pembrokeshire	7	8½	6	7½	5	6	4	4½	3	3½
Radnor	7	8½	5½	6½	5	6	4	4½	3	3½
Rutland	7	8½	6	7½	5	6	4	4½	3	3½
Shropshire	7	8	6	7	4½	5½	3½	4½	2½	3½
Somerset	7	8½	6	7½	5	6	4	4½	3	3½
Staffordshire	7	8	6	7	4½	5½	3½	4½	2½	3
Suffolk	7	8½	6	7½	5	6	4	4½	3	3½
Surrey	7	8½	6	7½	5	6	4	4½	3	3½
Sussex	7	8½	6	7½	5	6	4	4½	3	3½
Warwickshire	7	8½	6	7½	5	6	4	4½	3	3½
Westmorland	8½	10	7	8½	5½	6½	4	5	3	3½
Wiltshire	7	8½	6	7½	5	6	4	4½	3	3½
Worcestershire	7	8½	6	7½	5	6	4	4½	3	3½
Yorkshire	8½	10	7	8½	5½	6½	4	5	3½	3½

[1] W. = Weekdays. [2] S. = Sundays

TABLE V.

County	Classes of Workers	Minimum weekly wage	Overtime rate per hour		Age at which rates apply
			Week-days	Sun-days	
(1)	(2)	(3)	(4)	(5)	(6)
		s. *d.*	*d.*	*d.*	
Anglesey... ...	Horseman, cowman, shepherd, hwsmon (bailiff)	36 0	8½	10	18 & over
Bedfordshire ...	Horsekeeper, cowman and shepherd	36 0	8½	10	„
Berkshire ...	Head carter and head cowman	37 0	8½	10	„
„	Head shepherd ...	35 0	„	„	„
„	Under cowman ...	34 0	„	„	„
„	Under carter and under shepherd	33 0	„	„	„
Brecon	Boys who are wholly or partially boarded and lodged by their employers and whose duties include attending to horses or other stock	30 0	7	8½	17 to 18
		25 0	5½	6½	16 „ 17
		23 0	5	6	15 „ 16
		19 0	4	4½	14 „ 15
		15 0	3	3½	Under 14
Cambridgeshire	Horsekeeper, cowman and shepherd	36 0	8½	10	18 & over
Carnarvon ...	Horseman, cowman, shepherd, hwsmon (bailiff)	36 0	8½	10	„
Cheshire ...	Head stockman, head teamsman and head shepherd	40 0	9	10	„
„ ...	Second stockman, second teamsman and second shepherd	38 0	9	10	„
Cumberland ...	Horseman, cattleman, shepherd	42 0	10	1/-	„
Denbigh ...	Teamman, cattleman, cowman, shepherd, bailiff	35 0	8½	10	„
Derbyshire ...	Stockman, horseman, shepherd	36 0	9	9	„
Dorset	Carter, cowman and shepherd	36 0	8½	10	„
Durham	Horseman, cattleman and stockman (except wholetime shepherds)	38 0	10	1/-	19 & over
		35 0	9	11	18 to 19
		30 0	8	9½	17 „ 18
		25 0	6½	7½	16 „ 17
„ ...	Wholetime shepherd	43 0	—	—	19 & over
Flint	Teamman, cattleman, cowman, shepherd, bailiff	35 0	8½	10	18 & over
Gloucestershire	Head stockman, head horseman, head shepherd	37 0	8½	10	„
„	Under stockman, under horseman, under shepherd	34 0	8½	10	„
Hampshire ...	Carter, dairyman, cowman, shepherd	37 0	8½	10	„
Hertfordshire ...	Horseman, stockman, shepherd	38 0	9	11	21 & over
		37 0	8½	10	18 to 21
Huntingdonshire	Horsekeeper, cowman, shepherd	36 0	8½	10	18 & over
Kent	Horseman, stockman, shepherd	39 0	9	11	„

County	Classes of Workers	Minimum weekly wage	Overtime rate per hour		Age at which rates apply
			Week-days	Sun-days	
(1)	(2)	(3)	(4)	(5)	(6)
		s. d.	*d.*	*d.*	
Lincolnshire ...	Stockman, teamsman, shepherd (confined men)	40 0	9	11	21 & over
		36 0	8½	10	18 to 21
Merioneth ...	Stockman, teamster, carter, shepherd	35 0	8½	10	18 & over
„ ...	Boys who are wholly or partially boarded and lodged by their employers, and whose duties include attending to horses or other stock	30 0	7	8½	17 to 18
		25 0	5½	6½	16 „ 17
		23 0	5	6	15 „ 16
		19 0	4	4½	14 „ 15
		15 0	3	3½	Under 14
Middlesex ...	Horseman, stockman, shepherd	40 0	9	11	21 & over
		37 0	8½	10	18 to 21
Montgomery ...	Stockman, teamster, carter, shepherd	35 0	8½	10	18 & over
„ ...	Boys who are wholly or partially boarded and lodged by their employers, and whose duties include attending to horses or other stock	30 0	7	8½	17 to 18
		25 0	5½	6½	16 „ 17
		23 0	6	6	15 „ 16
		19 0	4	4½	14 „ 15
		15 0	3	3½	Under 14
Norfolk	Teamman, shepherd and cowman	36 0	8½	10	18 & over
„	Bullock-tender, sheep-tender	35 0	—	—	„
Northampton-shire	Shepherd, stockman, waggoner and milk-man	36 0	8½	10	„
Northumberland	Horseman, cattleman, stockman (except wholetime shep-herds)	38 0	10	1/-	19 & over
		35 0	9	11	18 to 19
		30 0	8	9½	17 to 18
		25 0	6½	7½	16 to 17
„ ... „	Wholetime shepherd	43 0	—	—	19 & over
Radnor	Boys who are wholly or partially boarded and lodged by their employers, and whose duties include attending to horses or other stock	30 0	7	8½	17 to 18
		25 0	5½	6½	16 to 17
		23 0	5	6	15 to 16
		17 0	4	4½	14 to 15
		15 0	3	3½	Under 14
Shropshire ...	Teamsman, cowman and shepherd	39 0	9	10	21 & over
		37 0	9	9	18 to 21
Suffolk	Horseman, stockman, shepherd	36 0	8½	10	18 & over
Surrey	Stockman, shepherd, horseman	39 0	9	11	21 & over
		37 0	8½	10	18 to 21
Sussex	Teamman, cowman, shepherd	38 0	9	11	21 & over
		36 0	8½	10	18 to 21
Warwickshire ...	Stockman, shepherd, horseman	38 0	8½	10	21 & over
		36 0	8½	10	18 to 21
Westmorland ...	Horseman, cattleman, shepherd	42 0	10	1/-	18 & over
Wiltshire ...	Head carter, head cowman, head shep-herd	37 0	8½	10	„
Yorkshire ...	Horseman, cowman, shepherd	41 0	9½	11½	21 & over
		39 0	9½	11½	18 to 21

SPECIAL CLASSES OF MALE WORKERS.

Notes to Table V.

1. In lieu of the minimum and overtime rates fixed for male workmen, and set out in Tables 1, 2, 3, and 4, male workmen of the classes specified in Column 2 of Table 5 below are entitled to be paid at the rates set out in Columns (3), (4) and (5) of the Table.

2. The weekday overtime rate is payable in respect of all employment in excess of 6½ hours on a Saturday, or on such other day (not being Sunday) in every week, as may be agreed between the employer and the worker, except time spent on such day by stockmen of any class in connection with the feeding and cleaning of stock. The weekday and Sunday overtime rates are also payable (except in the case of Anglesey, Carnarvon, Cheshire, Denbigh, Derbyshire, and Flint) in respect of any time spent on weekdays and Sundays respectively in excess of the hours customary in the area of the District Wages Committee in the case of the respective classes of workers.

3. Subject to the provisions explained in the previous clause as to payment of overtime rates, the minimum weekly wage set out in Column (3) of the Table is the wage payable (except in the cases of Anglesey, Carnarvon, Cheshire, Denbigh. Derbyshire and Flint, as to which the actual Orders should be consulted) for a week consisting of the hours of employment, *whether on weekdays or on Sunday*, customary in the area of the District Wages Committee in the case of the respective classes of workers.

FEMALE WORKERS.

Notes to Table VI.

1. The minimum hourly rates set out in Table 6 below are the rates payable for employment on any weekday, not including overtime.

2. The Sunday overtime rate is payable in respect of all employment on a Sunday. The weekday overtime rate is payable in respect of :—(*a*) All employment on any weekday before 7 a.m. or after 5 p.m. ; (*b*) all employment in excess of 6½ hours on a Saturday, or on such other day (not being Sunday) in every week, as may be agreed between the employer and the worker ; (*c*) all employment on any weekday not covered by the provision set out in the preceding clause (*d*), in excess of the number of hours specified below, that is to say :—

(1) 8½ hours in summer and 8 hours in winter in Bedfordshire, Cambridgeshire, Cumberland, Derbyshire, Devonshire, Dorset, Furness District of Lancashire, Hertfordshire, Huntingdonshire, Kent, Middlesex, Northamptonshire, Northumberland, Nottinghamshire, Westmorland, Wiltshire.

(2) 8¼ hours all the year round in Cheshire, Lancashire, Shropshire, Glamorgan, Merioneth, Monmouth, Montgomery ; and

(3) 8 hours all the year round in all other counties.

3. Meal times are not included in the hours of work for the purpose of calculating the wage payable under the Board's Orders, but any time during which a worker, by reason of weather conditions, is prevented by her employer from working, although she is present at the place of employment and is ready for work, is to be reckoned in the hours of work for the purpose of payment of the minimum wage.

4. The minimum rates and overtime rates set out in Table VI. are subject to a deduction of ½*d*. per hour during the first three months of a worker's employment in agriculture.

5. "Summer" is the period from the first Monday in March to the last Sunday in October ; "Winter" is the remaining period of the year.

TABLE VI.—*Female Workers.*

County	MINIMUM AND OVERTIME RATES PER HOUR															
	18 years of age and over			17 and under 18 years			16 and under 17 years			15 and under 16 years			14 and under 15 years			Under 14 years		
	Minimum rate per hour	Overtime rates per hour		Minimum rate per hour	Overtime rates per hour		Minimum rate per hour	Overtime rates per hour		Minimum rate per hour	Overtime rates per hour		Minimum rate per hour	Overtime rates per hour		Minimum rate per hour	Overtime rates per hour	
		Weekdays	Sundays		Weekdays	Sundays		Weekdays	Sundays		Weekdays	Sundays		Weekdays	Sundays		Weekdays	Sundays
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
Cumberland . .	6	7½	9	5½	7	8	5	6	7½	4½	5½	7	4	5	6	3½	4½	5
Furness District of Lancashire . .	6	7½	9	5½	7	8	5	6	7½	4½	5½	7	4	5	6	3½	4½	5
Yorkshire . . .	6	7½	9	5½	7	8	5	6	7½	4½	5½	7	4	5	6	3½	4½	5
Westmorland . .	6	7½	9	5½	7	8	5	6	7¼	4½	5½	7	4	5	6	3½	4½	5
[1]All other counties in England and Wales	5	6	7½	4½	5½	7	4	5	6	3½	4½	5	3	4	4½	2½	3	4

[1] In the case of Northumberland, the rates set out in Table 6 apply only to workers other than *whole time workers employed by the week or longer period.* The minimum and overtime rates applicable to whole-time female workers in Northumberland employed by the week or any longer period are set out in Table 7.

TABLE VII.—*Whole-time Female Workers in Northumberland employed by the week or longer period.*

County	Minimum and Overtime Rates																	
	18 years of age and over			17 and under 18 years			16 and under 17 years			15 and under 16 years			14 and under 15 years			Under 14 years		
	Minimum weekly wage	Overtime rates per hour		Minimum weekly wage	Overtime rates per hour		Minimum weekly wage	Overtime rates per hour		Minimum weekly wage	Overtime rates per hour		Minimum weekly wage	Overtime rates per hour		Minimum weekly wage	Overtime rates per hour	
		Weekdays	Sundays		Weekdays	Sundays		Weekdays	Sundays		Weekdays	Sundays		Weekdays	Sundays		Weekdays	Sundays
	s. *d.*	*d.*	*d.*	*s.* *d.*	*d.*	*d.*	*s.* *d.*	*d.*	*d.*	*s.* *d.*	*d.*	*d.*	*s.* *d.*	*d.*	*d.*	*s.* *d.*	*d.*	*d.*
Northumberland .	22 6	6	7½	20 3	5½	7	18 0	5	6	15 9	4½	5	13 6	4	4½	11 3	3	4

Notes to Table VII.

1. The minimum weekly wages set out in Table VII. are the wages payable in respect of 54 hours per week (excluding Sunday) in summer and of 48 hours per week (excluding Sunday) in winter.

2. The Sunday overtime rate is payable in respect of all employment on a Sunday. The weekday overtime is payable in respect of :—(*a*) All employment in excess of 6½ hours on a Saturday, or on such other day (not being Sunday) in every week, as may be agreed between the employer and the worker ; and (*b*) all employment in excess of 54 hours in any week (excluding Sunday) in Summer and in excess of 48 hours in any week (excluding Sunday) in Winter.

3. The Order provides that when by mutual agreement between employer and worker the hours of work of a whole-time worker employed by the week or longer (exclusive of overtime employment) are less than 54 in summer or 48 in winter, the full weekly wage as shown in the Table shall nevertheless be payable.

4. Meal times are not included in the hours of work for the purpose of calculating the wage payable under the Board's Order, but any time during which a worker, by reason of weather conditions, is prevented by her employer from working, although she is present at the place of employment and is ready for work, is to be reckoned in the hours of work for the purpose of payment of the minimum wage.

5. The minimum weekly wages are subject to a deduction of 2*s.* 3*d.* per week and the overtime rates to a deduction of ½*d.* an hour during the first three months of a worker's employment in agriculture.

6. "Summer" is the period from the first Monday in March to the last Sunday in October ; "winter" is the remaining period of the year.

AGRICULTURAL STATISTICS, 1918.

[The Society is again indebted to the Board of Agriculture and Fisheries for their kindness in supplying, for inclusion in the Journal, the usual detailed and comparative tables of the latest agricultural statistics. For fuller information than can be given in the small space available here, the Department's own admirable series of Reports on Agricultural Statistics should, of course, be consulted.—Ed.]

Acreage.

Particulars of the acreage under the various crops and of the number of live stock are given in Table I. Although the total acreage under crops and grass showed a slight reduction in 1918 as compared with 1917 the effect of farmers' efforts under the stimulus of the Food Production Department's ploughing-up programme is apparent from the large increase in the area of arable land which in England and Wales[1] together extended to 12,398,640 acres, an increase of 1,152,534 acres (10 per cent.) on the previous year and of 1,400,386 acres (12½ per cent.) on 1914. This great result was, of course, at the expense of permanent pasture, the area of which shrunk by

[1] Although for purposes of reference Tables I. and II. give details also for the other parts of the United Kingdom, exigencies of space make it necessary to confine the review more particularly to England and Wales.

1,246,503 acres, the balance of 93,969 acres in the total diminution being accounted for by the net reduction in the total area under crops and grass. The great change brought about by the Government's policy, backed up by private enterprise, may be seen more readily by noting that for every 100 acres of arable land in 1914 there were 160 acres of permanent grass, whereas in 1918 the proportion of the latter fell to 118 acres.

The agricultural effort was, of course, concentrated on an increased production of corn and potatoes, and as far as the **Wheat** acreage is concerned the gratifying result was achieved of the total area reaching 2,556,661 acres, an increase of 638,176 acres on 1917 and of 765,861 acres on the average of the three pre-war years 1912-14. The importance of this may be gauged from the fact that the record established in 1915 was exceeded by nearly 400,000 acres. **Barley** also showed an increase over 1917, the total acreage being 1,500,809. This is not only the highest acreage reached during the war period, but is also slightly in excess of the average for the three pre-war years 1912-14. When it is remembered that an increase of 130,000 acres was recorded in 1916, and a further 100,000 in 1917, and taking into account the continued reduction in the demand for barley for distillation the present increase of 41,000 acres may be regarded as a remarkable result of war effort. A great increase has also been achieved in the area sown with **Oats**, the figure for 1918 of 2,780,063 acres, representing an increase of 521,154 acres (23 per cent.) over the previous year, of 850,446 over 1914, and of nearly 500,000 acres over the record year of 1895. The figures for Scotland and Ireland are also the highest on record, the total for the United Kingdom being almost 900,000 acres in excess of 1917, and twice that amount in excess of 1914. Whilst **Rye** is not comparable in importance with the other cereal crops, the percentage increase in the area devoted to it is far greater than even that of wheat. The 1918 total of 101,432 acres in England and Wales is an increase of 45,419 acres (81 per cent.) over the previous year. The total acreage for the four cereal crops (10,394,413 acres), showing as it does a rise of 1,633,450 acres over 1917, and of 2,649,236 acres over 1914, presents the climax of the effort on the part of the Food Production Department and of individual farmers to overcome the food problems arising out of the war. In England and Wales the corresponding figures are; total 1918, 6,938,965 acres, increase over 1917, 1,245,762 acres, and over 1914, 1,643,171 acres.

The continued decrease of the area under **Beans** since 1914 has at length been arrested, and the present area of 250,681 shows an increase of 40,089 acres over the previous year. There is still a deficiency, however, of 34,000 acres on the area

sown to this crop immediately prior to the war. On the other hand the acreage under **Peas** is the highest since 1912, the figure of 150,104 acres being 19,105 above that of 1917, and 20,000 in excess of 1914. The combined area under the two pulse crops is therefore 400,785 acres as compared with 331,591 acres in 1917, and 462,857 acres in 1914. The great boom in the cultivation of **Potatoes** which was evidenced by an increase in the United Kingdom area under this crop of 220,000 acres in 1916-17, resulted in a further increase of 135,000 acres in the year under review, the figure of 1,511,640 acres being by far the highest on record, and representing an increase over the average of the three pre-war years 1912-14 of 300,000 acres.

Combining the figures already given it will be found that the acreage in England and Wales devoted to the production of the main food crops (*i.e.*, cereals and potatoes) is 7,572,797 acres as compared with 6,201,190 acres in 1917, and 5,757,415 acres in 1914.

In the area under **Root Crops**, however, we are faced with a decrease, for whereas **Mangolds** have increased 12,450 acres over the acreage (388,842) for 1917, this is more than balanced by the decrease (61,556 acres) in the area under **Turnips and Swedes.** The combined acreage of these crops is 1,312,110 acres against 1,361,216 acres in the previous year, and 1,477,461 acres in 1914.

As might be expected, a shrinkage was caused in the area under **Rotation Grasses** by the large increase in lands required for the production of human food. In only one section of the United Kingdom, viz., Ireland, was there any increase in this respect, and this was almost negligible. The total reduction of 516,687 acres was chiefly brought about in England and Wales, where the acreage was about 300,000 acres less than in 1914.

A large reduction is again noticeable in the acreage under **Vetches and Tares**, this being the lowest ever recorded for Great Britain, whilst **Small Fruit** and other minor crops continued to decline. The acreage under Small Fruit is 6,692 acres less than last year, and is the lowest on record since 1899.

Live Stock.

The increase in the number of **Horses** (excluding non-agricultural horses) which had been apparent since 1915, has continued during the year 1917-1918, the total in Great Britain having risen from 1,323,923 to 1,336,828, the highest since 1912. This increase of 12,905 is entirely confined to England and Wales. Of the total of 1,336,828, those used entirely in agricultural work number 959,797, an excess of 33,000 over the number so employed in 1914, in spite of the increasing use of motor traction on farms. On the other hand, the number

of stallions has materially decreased, the figure in respect of England and Wales for this year (7,707) being 702 (8 per cent.) less than in 1917, and only 200 in excess of the pre-war number. Unbroken Horses have considerably decreased, the increase of 11,000 recorded last year having been more than wiped out, and the outlook for the future is not therefore very good. The number of foals is less even than in 1914.

Although there is a fairly considerable drop in the number of **Cattle** as compared with 1917, the numbers in Great Britain being 7,410,327 against 7,437,007, this number is far above anything recorded before 1916, and moreover the reduction is confined to Wales. Considering the large ploughing-up programme which was carried out, the result is very favourable, and in conjunction with the result achieved in the production of food crops, shows the efficiency of the methods adopted to overcome the food shortage brought about by the war. There was in fact an increase of 25,845 in the number of cows and heifers in milk, a fact which should give great satisfaction in view of the shortage of milk. There is still, however, a deficiency of nearly 70,000 to be made up before the pre-war figure is reached. Another satisfactory increase is also shown in the number of cows and heifers in calf, the continual rise in this figure since 1915 having been well maintained. The record of last year has been beaten by no less than 98,000. Beef cattle continue to decline, though the decrease may chiefly be traced to the older beasts. Here the figure of 1,219,602 represents a reduction of 105,000, 80 per cent. of which is in England. The less mature animals have slightly increased in Scotland, but the total for Great Britain shows a decrease of 13,748 in those of one to two years old, and of 31,545 in those under one year. In spite of these reductions, there is still a fair margin above the 1914 figures, beasts of one to two years old having increased 186,000 and the other categories to a less extent.

As was to be expected from the reduction of the number of lambs recorded last year, and from the abnormal demands made for home-grown mutton, a further reduction has taken place in the number of **Sheep** in Great Britain. The great drop of nearly 1,000,000 last year has been followed by another of 690,000, and the resultant figure of 23,353.373 is nearly 600,000 below that of 1913, which was the smallest on record. The number of ewes kept for breeding has fallen by 397,553 as compared with 1917, and 311,865 as compared with 1914. The lowest on record (1913) exceeds the present total of 9,501,477 by 111,812. In Ireland also there has been a considerable diminution. Sheep for mutton have likewise decreased, the rise of 255,423 in sheep under one year having been

outnumbered by the decrease of 547,588 in the total of older animals. The corresponding figures for Ireland show similar tendencies, the result being a deficiency of 345,251 in the United Kingdom.

Pig-breeding appears to be in a very serious state, the constant decline during the war period having reduced the total in Great Britain by 809,176 (30 per cent.); of this reduction 226,413 took place during last year, and the figure now stands 105,379 below that of 1869. A satisfactory increase, however, has to be recorded in respect of Ireland, where last year's total of 947,472 has risen to 974,385. A rise is also noticeable in the number of sows kept for breeding, the present figure being 5,000 above that for 1916. This increase has taken place almost entirely in England, and is a hopeful sign for a much-needed replenishing of the stock of pigs in this country. Bacon pigs have been reduced from 1,509,829 to 1,279,182 in England and in like proportion in Wales and Scotland, but in Ireland a small increase has occurred.

Produce of Crops.

The large increase in arable land has naturally led to a corresponding increase in the main food crops; but what is still more satisfactory is that, in spite of the ploughing up of somewhat unsuitable lands, and the continued scarcity of labour, the yield per acre has also risen. Thus in the case of **Wheat** (Table II.) the record crop of 10,932,000 quarters in Great Britain has been brought about by the increase in yield of three bushels per acre. The surplus of 3,463,000 quarters (46 per cent.) over last year's crop was almost entirely grown in England, though the percentage increase is greatest in Wales. Here the 1917 total of 209,173 quarters has risen to 356,000 quarters in the year under review. In Ireland the figure has increased from 571,607 quarters to 711,000 quarters, but the yield per acre is slightly less than in 1917. Comparison with 1914 shows that the production of wheat has risen 3,305,000 quarters in England and Wales, whilst the high yield of 1885 has been exceeded by 1,234,000 quarters. The yield per acre of 33·2 bushels is the highest since 1909, and is 0·5 bushels above that of 1914. On the other hand, the Irish figure is the lowest since 1912.

The importance of **Barley** being relatively small compared with that of wheat, it is not to be expected that so large an increase would be noticeable in the total yield. Nevertheless, an increase of 529,000 quarters ($8\frac{1}{2}$ per cent.) has occurred over the 6,240,000 quarters of 1917. In the case of this crop a small decrease is observable in Scotland, but the increase has been fairly uniform in the other parts of the United Kingdom. The

yield in Great Britain is the largest during the war period, but was exceeded by 328,000 quarters in 1914. The Irish crop, on the other hand, is the largest ever recorded, the 1909 figure having been exceeded by about 2,000 quarters. As regards the yield per acre, increases have occurred in each country, that of three bushels in Wales being the greatest, and that in Scotland and Ireland (0·7) least. The average for the ten years 1908-1917 has also been very slightly exceeded.

The **Oat** crop, like that of wheat, is a record one, the 20,796,000 quarters in Great Britain representing an excess of 4,484,000 quarters (27½ per cent.) over 1917, and of 6,623,000 (46½ per cent.) over 1914. The yield per acre has only slightly increased, viz., from 39·54 bushels to 41·3. In England and Wales increases have been recorded of 2·9 bushels and 2·5 bushels respectively, whilst, as an offset against this, Scotland has decreased 0·35 bushels and Ireland 0·36 bushels. In every case, however, the present figures are above the average for the ten previous years, the net increase in the British Isles being 2·1 bushels.

The effect of the increased produce of cereals is best illustrated by converting the figures already given to their equivalent weight of grain, when it will be seen that the total production of breadstuffs (excluding potatoes) in the United Kingdom rose to 156,512,000 cwt., as compared with 132,626,000 cwt. in 1917, and with the average for the five years preceding the war of 118,954,000 cwt.

The excessively low yield per acre of **Beans** which was recorded last year has, fortunately, not continued, the present figure being, in fact, somewhat above the average. It may be remembered that last year's yield (17·79 bushels) was little more than half what it has been in good seasons, and therefore the increase to 29·6 bushels in 1918 is by no means so remarkable as it appears at a glance. It has meant, however, in conjunction with the increased acreage, the largest crop (921,900 quarters) produced during the war, but it is still 191,200 quarters short of the 1914 crop.

The other pulse crop, **Peas**, which are almost entirely grown in England, have increased both in quantity and in yield per acre. The English crop, which for three years had failed to reach 300,000 quarters, rose this year to 437,000. This is 162,000 quarters (59 per cent.) above 1917, and 66,000 (18 per cent.) above 1914. The yield per acre (27·5 bushels) is six bushels in excess of that in 1917, and 4½ bushels in excess of the 1914 figure. It is moreover the highest for ten years.

The yield per acre of **Potatoes** has very slightly decreased, but the larger acreage has brought about a not inconsiderable addition to the total produce. It must be borne in mind,

however, that the statistics are by no means exhaustive, as the official returns are confined to holdings above one acre; the number of allotments under one acre in extent has increased so rapidly since 1916, and these plots have so largely been used for potato-growing, that the total increase in the yield can only be surmised. Be that as it may, the official returns register an addition of 908,000 tons (20 per cent.) in Great Britain, and the total now stands at 5,359,000 tons. This is over 1,300,000 tons in excess of the produce of 1914, which was the record pre-war figure. A decrease from 4,153,000 tons to 3,863,000 tons has occurred during the year in Ireland, and the net increase in the United Kingdom is therefore 618,000 tons (7 per cent.). The great impetus given to the cultivation of the potato by the food crisis arising out of the war is shown by the margin of 1,746,000 tons (23 per cent.) over 1914. As already mentioned, the yield per acre has diminished, that for Great Britain being, nevertheless, the highest for ten years, 1917 alone excepted. Ireland was less favoured, and consequently the figure for the United Kingdom is somewhat below that for 1914.

The yield per acre of **Turnips and Swedes** has fallen considerably, and is now decidedly below average. This is chiefly due to the very poor results achieved in Scotland, where the yield has dropped from 19·44 bushels to 13·8, the lowest figure since 1903. Comparatively small increases in England and Wales have resulted in a drop of 1·2 bushels in Great Britain. An increase in Ireland has done much to restore the balance as regards the United Kingdom, where the yield now stands at 14·2 bushels per acre. Acreage has decreased slightly, with the result that the total produce does not equal that of 1917. In Great Britain the crop was the smallest since 1911, and represents a decrease of 2,735,000 tons (13½ per cent.) since 1917. In Wales, both the acreage and the yield per acre increased, but so small a proportion of the crop is grown in that country that the result was almost negligible.

A decrease has also occurred in the yield per acre of **Mangolds**, but here again the 1918 figure is still above the average. The yield in Great Britain is 20·6 bushels per acre as compared with 21·89 in 1917, the average for 1908-17 being 19·5. The acreage has risen a little, but not sufficiently to prevent a decrease of 255,000 tons (3 per cent.) in the total produce. The United Kingdom is, however, very little less than in 1917, owing to increases, both in acreage and yield in Ireland. Apart from last year, the crop is the largest since 1910, and is 798,000 tons (8 per cent.) in excess of that in 1914.

The yield per acre of **Hay** is again under average, though slight increases over last year are noticeable. In Great Britain the yield of hay from rotation grasses is 29·3 cwt. per acre as

compared with 29·11 in 1917, and with the ten years' average of 29·6, whilst in Ireland an increase of 1½ cwt. per acre still leaves the yield over 2 cwt. short of the average. Taking into account the reduced acreage, the result is a shortage of 369,000 tons in the crop in Great Britain, and of 340,000 tons in that of the United Kingdom. There is a surplus of 182,000 tons (4 per cent.), however, over the 1914 figure. The yield of hay from permanent grass shows very similar tendencies, the poor results of last year having been improved upon without, however, bringing the yield to its normal level. In England the figures are: 1918, 22·1 cwt.; 1917, 21·77; normal, 22·9. Acreage has lessened, and the net result is a decrease in produce. The English crop of 4,222,000 tons is 400,000 tons (9 per cent.) less than in 1917, and about the same amount short of 1914, and further reductions in other parts of the United Kingdom have brought the total to 7,939,000 tons, or 490,000 tons below 1917. The combined produce of hay of both categories is 12,332,000 tons as against 13,163,000 tons last year, and 12,403,000 tons in 1914. It must be borne in mind, however, that 1914 was a relatively poor year for hay.

Reference to Table III. will show that the crop of **Hops** in 1918 was by far the smallest on record. This is largely due to the shrinking in the acreage, which has been going on all through the war, until now only 15,666 acres are planted with this crop, against 36,661 acres in 1914. Besides this, the yield per acre, which is very variable, was not up to the average of 10 cwt. Only 8⅓ cwt. were produced this year, a drop of 4⅔ cwt. since 1917. The crop of 130,272 cwt. represents about two-fifths of the average for the last ten years, and is 377,000 cwt. (55 per cent.) lower than the 1914 crop. In Kent, where 72 per cent. of the total was grown, the yield was 9·54 cwt. per acre as compared with 14·32 cwt. in 1917.

Prices in England and Wales.

The control of prices throughout the year by the Ministry of Food has rendered the variations in the weekly return of corn prices (Table IV) of comparatively little interest. **Wheat** opened at 71*s.* 2*d.* per quarter and rose gradually for the first eight months of the year, reaching 74*s.* 8*d.* at the end of August. On the 31st of that month, an order of the Food Controller reduced the price of wheat harvested in 1918 to 75*s.* 6*d.* per quarter of 504 lbs., the equivalent of about 72*s.* per Imperial quarter. The price accordingly dropped to about that figure and remained constant for the rest of the year. The average for the year is 72*s.* 10*d.*, which, though 3*s.* lower than that for 1917, is nevertheless 39*s.* 6*d.* above the average of the five years preceding the war. **Barley** prices, which stood

[Continued on page 169.]

TABLE I.—Acreage under Crops and Grass; *and* Number *of* Live *Scotland, Great Britain, Ireland, and the United Kingdom*

	England		Wales		Scotland [5]	
	1918	1917	1918	1917	1918	1917
Total Area (excluding water)	Acres 32,387,409		Acres 4,750,155		Acres 19,069,683	
Total Acreage under Crops and Grass [1]	24,262,040	24,322,870	2,725,472	2,758,611	4,761,101	4,776,323
Arable Land	11,463,679	10,454,149	934,961	791,957	3,453,495	3,360,562
Permanent Grass [1]	12,798,361	13,868,721	1,790,511	1,966,654	1,307,606	1,415,761
Wheat	2,460,695	1,854,870	95,966	63,615	79,062	60,931
Barley or Bere	1,394,861	1,364,630	105,948	95,166	152,835	159,135
Oats	2,414,561	2,012,719	365,502	246,190	1,243,823	1,041,343
Mixed Corn [2]	113,799	(2)	27,720	(2)	4,072	(2)
Rye	101,199	55,138	233	875	5,650	4,963
Beans	247,787	209,311	2,894	1,281	[9] 7,275	[9] 6,135
Peas	149,230	130,193	874	806	417	396
Potatoes	596,607	473,342	37,225	34,645	169,497	147,717
Turnips and Swedes	858,516	921,553	52,302	50,821	396,689	414,305
Mangold	388,077	376,912	13,215	11,930	2,552	2,415
Cabbage	38,178	38,332	655	734	3,829	3,477
Kohl-Rabi	12,963	14,491	85	66	[11] —	[11] —
Rape	54,312	59,318	5,784	4,850	2,848	4,368
Vetches or Tares	61,449	78,207	550	557	[10] 15,697	[10] 11,901
Lucerne	39,885	49,907	184	306	6	6
Hops	15,666	16,946	—	—	—	—
Small Fruit	65,053	71,211	626	731	6,381	6,810
Clover, Sainfoin, and Grasses under Rotation	1,875,363	2,226,061	219,864	273,484	1,354,290	1,487,950
Other Crops	170,302	149,482	1,792	2,128	3,743	2,673
Bare Fallow	405,176	351,526	3,542	3,772	4,829	6,037
	No.	No.	No.	No.	No.	No.
Horses used for Agricultural purposes [3]	734,381	712,956	88,047	83,082	137,369	135,418
Stallions [4]	6,519	6,963	1,188	1,446	1,001	1,132
Unbroken Horses: One year and above	187,582	193,900	32,268	35,092	35,250	35,874
Unbroken Horses: Under one year	80,508	84,063	19,562	20,299	13,153	13,698
Total	1,008,990	997,882	141,065	139,919	186,773	186,122
Other Horses	203,078	212,663	22,669	22,358	23,251	23,926
TOTAL OF HORSES	1,212,068	1,210,545	163,764	162,277	210,024	210,048
Cows and Heifers in milk	1,623,350	1,591,308	234,845	240,135	345,821	346,728
Cows in calf but not in milk	299,426	242,338	35,664	29,199	52,802	45,143
Heifers in calf	355,981	328,260	28,700	33,554	53,666	49,931
Other Cattle:—Two years and above	929,435	1,010,682	71,334	83,088	218,833	230,878
" " One year and under two	1,138,675	1,148,103	199,836	205,219	293,516	292,453
" " Under one year	1,077,336	1,103,790	205,903	211,472	245,204	244,726
TOTAL OF CATTLE	5,424,203	5,424,481	776,282	802,667	1,209,842	1,209,859
Ewes kept for Breeding	4,963,696	5,247,246	1,523,079	1,624,783	3,014,702	3,027,001
Other Sheep:—One year and above	2,529,520	2,832,990	631,197	730,530	1,067,255	1,212,040
" " Under one year	5,490,320	5,422,108	1,337,363	1,312,200	2,796,241	2,634,193
TOTAL OF SHEEP	12,983,536	13,502,344	3,491,639	3,667,513	6,878,198	6,873,234
Sows kept for Breeding	262,371	226,693	27,169	27,598	16,082	14,794
Other Pigs	1,279,182	1,509,829	128,344	154,421	111,925	118,151
TOTAL OF PIGS	1,541,553	1,736,522	155,513	182,019	128,007	132,945

[1] Not including Mountain and Heath Land.
[2] The areas of Mixed Corn were apportioned in previous years among Wheat, Barley and Oats.
[3] Including Mares kept for Breeding.
[4] Above two years old, used, or intended to be used, for service.
[5] Furnished by the Board of Agriculture for Scotland.
[6] Furnished by the Department of Agriculture and Technical Instruction for Ireland.

Stock, *as returned on June* 4, 1918 *and* 1917, *in England, Wales, (including the Isle of Man and the Channel Islands).*

	Great Britain		Ireland[6]		United Kingdom.	
	1918	1917	1918	1917	1918	1917
Total Area (excluding water)	Acres 56,207,247		Acres 20,247,294		Acres 76,639,994 [8]	
Total Acreage under Crops and Grass[1]	31,748,613	31,857,804	14,392,975	14,354,554	46,266,748	46,336,792
Arable Land	15,852,135	14,606,668	5,271,830	5,046,008	21,220,767	19,748,414
Permanent Grass[1]	15,896,478	17,251,136	9,121,145	9,308,546	25,045,981	26,588,378
Wheat	2,635,723	1,979,416	158,222	124,082	2,796,401	2,105,929
Barley or Bere	1,653,644	1,618,931	185,758	177,135	1,840,363	1,797,227
Oats	4,023,886	3,300,252	1,589,501	1,463,737	5,641,188	4,789,010
Mixed Corn[2]	145,591	(2)	—	—	145,621	(11)
Rye	107,082	60,976	9,175	7,640	116,461	68,797
Beans [9]	257,956	216,727	2,269	1,365	410,951	218,234
Peas	150,521	131,395		268		131,744
Potatoes	803,329	655,704	695,396	709,263	1,511,640	1,377,311
Turnips and Swedes	1,307,507	1,386,679	293,857	293,452	1,669,018	1,688,146
Mangold	403,844	391,257	[12] 96,437	[12] 93,074	[12]501,224	[12]485,230
Cabbage	42,662	42,543	26,502	19,953	69,286	62,617
Hops	15,666	16,946	—	—	15,666	16,946
Small Fruit	72,060	78,752	[7] 18,593	[7] 17,024	[7] 90,939	[7] 96,041
Clover, Sainfoin, and Grasses under Rotation	3,449,517	3,987,495	2,031,120	2,008,139	5,520,796	6,037,483
Other Crops	369,600	378,260	165,000	130,876	537,089	511,774
Bare Fallow	413,547	361,335	—	—	414,124	361,925
	No.	No.	No.	No.	No.	No.
Horses used for Agricultural purposes[3]	959,797	931,456	413,617	389,711	1,379,486	1,327,252
Unbroken Horses (including stallions): One year and above	263,808	274,407	105,400	100,931	370,900	376,867
Unbroken Horses (including stallions): Under one year	113,223	118,060	51,893	56,530	165,961	175,428
TOTAL OF HORSES	1,336,828	1,323,923	570,910	547,172	1,916,347	1,879,547
Cows and Heifers in milk	2,204,016	2,178,171	1,481,291	1,504,933	4,087,762	4,014,132
Cows in calf but not in milk	387,892	316,680				
Heifers in calf	438,347	411,745	75,548	87,042	516,079	500,671
Other Cattle:—						
Two years and above	1,219,602	1,324,648	1,066,572	1,010,788	2,289,684	2,338,407
One year and under two	1,632,027	1,645,775	1,106,445	1,102,511	2,747,295	2,757,222
Under one year	1,528,443	1,559,988	1,133,426	1,203,242	2,670,329	2,771,804
TOTAL OF CATTLE	7,410,327	7,437,007	4,863,282	4,908,516	12,311,149	12,382,236
Ewes kept for Breeding	9,501,477	9,899,030	1,448,960	1,510,940	10,985,361	11,444,673
Other Sheep:—						
One year and above	4,227,972	4,775,560	672,069	744,987	4,905,964	5,527,120
Under one year	9,623,924	9,368,501	1,506,149	1,488,526	11,171,356	10,895,451
TOTAL OF SHEEP	23,353,373	24,043,091	3,627,178	3,744,453	27,062,681	27,867,244
Sows kept for Breeding	305,622	289,085	104,782	104,027	412,065	374,320
Other Pigs	1,519,451	1,762,401	869,603	843,445	2,397,150	2,633,596
TOTAL OF PIGS	1,825,073	2,051,486	974,385	947,472	2,809,215	3,007,916

[7] Figures for Ireland include Orchards.
[8] Figures for Jersey include Water.
[9] Figures for Scotland relate only to Beans harvested as corn.
[10] Figures for Scotland include Beans, Mashlum, &c., for Fodder.
[11] Kohl-Rabi is not separately distinguished in Scotland.
[12] Figures for Ireland include Beetroot.

TABLE II.—Total Produce, Acreage, and Yield per Acre *of* 1918 *and* 1917, *with the Average*

Crops	Total Produce		Acreage		Yield per Acre		Average of the Ten Years
	1918	1917	1918	1917	1918	1917	1908-1917
WHEAT.	Qrs.	Qrs.	Acres	Acres.	Bush.	Bush.	Bush.
England	10,174,000	6,955,403	2,460,695	1,854,870	33·1	30·00	31·1
Wales	356,000	209,173	95,966	63,615	29·7	26·30	27·6
Scotland	402,000	304,169	79,062	60,931	40·6	39·94	39·9
GREAT BRITAIN	10,932,000	7,468,745	2,635,723	1,979,416	33·2	30·19	31·3
Ireland	711,000	571,607	157,326	124,082	36·2	36·35	37·2
UNITED KINGDOM	11,643,000	8,040,352	2,793,049	2,103,498	33·3	30·58	31·4
BARLEY[2].							
England	5,666,000	5,198,332	1,394,861	1,364,630	32·5	30·47	32·0
Wales	414,000	336,947	105,948	95,166	31·3	28·32	30·5
Scotland	677,000	704,788	152,835	159,135	35·4	35·44	35·4
GREAT BRITAIN	6,757,000	6,240,067	1,653,644	1,618,931	32·7	30·84	32·3
Ireland	1,003,000	944,776	184,712	177,135	43·4	42·67	42·8
UNITED KINGDOM	7,760,000	7,184,843	1,838,356	1,796,066	33·8	32·00	33·6
OATS.							
England	12,661,000	9,813,404	2,414,559	2,012,719	41·9	39·01	39·8
Wales	1,678,000	1,051,661	365,502	246,190	36·7	34·17	34·9
Scotland	6,457,000	5,446,931	1,243,823	1,041,343	41·5	41·85	38·9
GREAT BRITAIN	20,796,000	16,311,996	4,023,884	3,300,252	41·3	39·54	39·2
Ireland	10,400,000	9,708,913	1,579,537	1,463,737	52·7	53·06	50·4
UNITED KINGDOM	31,196,000	26,020,909	5,603,421	4,763,989	44·5	43·70	42·4
BEANS.							
England	879,000	432,743	239,429	202,331	29·4	17·11	27·7
Wales	9,700	3,569	2,668	1,068	29·1	26·73	27·3
Scotland	33,200	29,679	7,275	6,135	36·5	38·70	36·8
GREAT BRITAIN	921,900	465,991	[4]249,372	[4]209,534	29·6	17·79	27·9
Ireland	9,400	8,090	1,850	1,365	40·9	47·41	43·1
UNITED KINGDOM	931,300	474,081	251,222	210,899	29·7	17·98	28·9
PEAS.							
England	437,000	275,426	127,147	102,374	27·5	21·52	24·9
Wales	1,900	1,503	710	588	21·6	20·45	22·5
Scotland	270	162	86	64	25·5	20·21	26·0
GREAT BRITAIN	439,170	277,091	[4]127,943	[4]103,026	27·5	21·52	24·9
Ireland	1,500	1,050	421	268	28·4	31·34	29·3
UNITED KINGDOM	440,670	278,141	128,364	103,294	27·5	21·54	25·5

[1] The particulars for Ireland have been furnished by the Department of Agriculture and Technical Instruction for Ireland, and those for Scotland, by the Board of Agriculture for Scotland. No Produce Statistics are collected for the Channel Islands and the Isle of Man.

[2] Including Bere.

[3] No Hops are grown in any other part of the United Kingdom.

each of the Principal Crops *in the* United Kingdom[1] *in of the Ten Years* 1908–1917.

Crops—*continued*	Total Produce		Acreage		Yield per Acre		Average of the Ten Years
	1918	1917	1918	1917	1918	1917	1908-1917
POTATOES.	Tons	Tons	Acres	Acres	Tons	Tons	Tons
England	3,987,000	3,143,323	596,607	473,342	6·7	6·64	6·3
Wales	222,000	197,672	37,225	34,645	6·0	5·71	5·5
Scotland	1,151,000	1,110,085	169,497	147,717	6·8	7·51	6·5
GREAT BRITAIN	5,360,000	4,451,080	803,329	655,704	6·7	6·79	6·3
Ireland	3,863,000	4,152,740	701,847	709,263	5·5	5·86	5·3
UNITED KINGDOM	9,223,000	8,603,820	1,505,176	1,364,967	6·1	6·30	5·8
TURNIPS AND SWEDES.							
England	11,233,000	11,413,923	[5]856,946	[5]918,313	13·1	12·43	12·9
Wales	785,000	749,701	52,302	50,818	15·0	14·75	15·4
Scotland	5,514,000	8,053,160	396,689	414,305	13·9	19·44	16·9
GREAT BRITAIN	17,532,000	20,216,784	1,305,937	1,383,436	13·4	14·61	14·2
Ireland	5,303,000	4,624,834	294,795	293,452	18·0	15·76	17·2
UNITED KINGDOM	22,835,000	24,841,618	1,600,732	1,676,888	14·3	14·81	14·6
MANGOLD.							
England	7,988,000	8,263,255	[5]386,508	[5]375,525	20·7	22·00	19·5
Wales	243,000	218,918	13,215	11,928	18·4	18·35	18·1
Scotland	49,000	52,699	2,552	2,415	19·2	21·82	19·9
GREAT BRITAIN	8,280,000	8,534,872	402,275	389,868	20·6	21·89	19·5
Ireland	2,041,000	1,834,164	97,663	93,074	20·9	19·71	19·9
UNITED KINGDOM	10,321,000	10,369,036	499,938	482,942	20·6	21·47	19·5
HAY *from* CLOVER, SAINFOIN, &c.					Cwt.	Cwt.	Cwt.
England	1,918,000	2,183,756	1,301,694	1,504,255	29·5	29·03	29·5
Wales	180,000	220,271	144,810	177,644	24·9	24·80	25·5
Scotland	594,000	657,368	389,472	421,502	30·5	31·19	31·5
GREAT BRITAIN	2,692,000	3,061,395	1,835,976	2,103,401	29·3	29·11	29·6
Ireland	1,701,000	1,671,828	967,437	992,252	35·2	33·70	37·5
UNITED KINGDOM	4,393,000	4,733,223	2,803,413	3,095,653	31·3	30·58	32·2
HAY *from* PERMANENT GRASS.							
England	4,222,000	4,622,141	3,812,485	4,246,066	22·1	21·77	22·9
Wales	466,000	533,335	486,013	548,147	19·2	19·46	20·0
Scotland	224,000	243,714	148,874	159,744	30·1	30·51	30·0
GREAT BRITAIN	4,912,000	5,399,190	4,447,372	4,953,957	22·1	21·80	22·9
Ireland	3,027,000	3,030,114	1,502,980	1,540,471	40·3	39·34	43·1
UNITED KINGDOM	7,939,000	8,429,304	5,950,352	6,494,428	26·7	25·96	27·9
HOPS.	Cwt.	Cwt.					
England[3]	130,000	220,719	15,666	16,946	8·3	13·02	10·0

[4] Exclusive of a certain area (amounting in 1918 to 8,584 acres of beans, and 22,247 acres of peas) the produce of which was cut or picked green.

[5] Exclusive of a certain area (amounting in 1918 to 1,570 acres of turnips and swedes and 1,5[illegible] acres of mangolds) on which the crops were grown for the production of seed.

TABLE III.—*Estimated Total Production of* Hops *in the Years* 1918 *and* 1917, *with the Acreage and Estimated Average Yield per Statute Acre, in each County of England in which Hops were grown.*

Counties, &c.	Estimated total produce		Acreage returned on 4th June		Estimated average yield per acre	
	1918	1917	1918	1917	1918	1917
	Cwt.	Cwt.	Acres	Acres	Cwt.	Cwt.
Kent—East	23,303	31,116	2,371	2,351	9·83	13·24
Kent—Mid.	34,870	59,696	3,336	3,667	10 45	16·28
Kent—Weald	34,720	59,084	4,032	4,447	8·61	13·29
Total, Kent	92,893	149,896	9,739	10,465	9·54	14·32
Hants	5,984	11,578	717	790	8·35	14·66
Hereford	14,335	29,536	2,331	2,629	6·15	11·23
Salop	384	424	48	53	8·00	8·00
Surrey	959	1,474	193	189	4·97	7·80
Sussex	7,060	16,049	1,310	1,478	5·39	10·86
Worcester	8,657	11,762	1,328	1,342	6·52	8·76
Total	130,272	220,719	15,666	16,946	8·32	13·02

TABLE IV.—*Average* Prices *of* British Corn *per Imperial Quarter in England and Wales, as ascertained under the Corn Returns Act*, 1882, *in each Week of the Year* 1918.

Week ended	Wheat	Barley	Oats	Week ended	Wheat	Barley	Oats
	s. d.	s. d.	s. d.		s. d.	s. d.	s. d.
January 5	71 2	58 0	45 5	July 6	74 4	61 7	46 10
January 12	71 2	58 2	46 9	July 13	74 4	57 5	47 0
January 19	71 3	58 1	47 9	July 20	74 3	60 5	45 4
January 26	71 1	58 7	48 2	July 27	74 3	56 11	46 2
February 2	71 2	58 10	50 2	August 3	74 3	57 1	45 10
February 9	72 0	59 0	50 6	August 10	74 7	57 7	46 3
February 16	72 3	58 11	52 0	August 17	74 2	61 4	55 11
February 23	72 2	58 9	52 3	August 24	74 8	62 6	56 9
March 2	72 2	57 9	52 0	August 31	74 8	60 1	57 11
March 9	72 3	58 5	52 2	September 7	72 3	60 4	56 9
March 16	72 4	56 10	51 0	September 14	72 5	60 1	49 2
March 23	72 3	56 9	50 3	September 21	72 6	60 4	49 11
March 30	72 4	56 7	48 10	September 28	72 7	60 3	50 3
April 6	72 11	56 7	49 10	October 5	72 8	60 3	50 9
April 13	73 3	56 6	47 2	October 12	72 6	60 3	51 6
April 20	73 3	56 6	47 0	October 19	72 7	60 3	50 9
April 27	73 3	56 10	46 8	October 26	72 5	60 3	50 5
May 4	73 5	56 5	47 4	November 2	72 4	60 3	50 8
May 11	73 5	56 6	47 6	November 9	72 4	60 3	49 11
May 18	73 4	56 6	46 4	November 16	72 5	60 3	49 10
May 25	73 3	56 6	47 8	November 23	72 4	60 10	51 1
June 1	73 8	60 0	44 9	November 30	72 3	62 2	50 4
June 8	73 11	59 2	45 5	December 7	72 4	62 6	51 4
June 15	74 3	57 9	45 7	December 14	72 3	62 7	51 4
June 22	74 4	58 5	47 8	December 21	72 4	62 3	50 5
June 29	74 4	57 10	46 4	December 28	72 3	62 3	50 6
				Average of year.	72 10	59 0	49 4

TABLE V.—*Average Annual Prices per Quarter and Total Quantities of* British Corn *returned as sold in the Towns in England and Wales making Returns under the Corn Returns Act*, 1882, *in the Years* 1914—1918.

Years	Wheat	Barley	Oats	Wheat	Barley	Oats
	s. d.	*s. d.*	*s. d.*	Qrs.	Qrs.	Qrs.
1914	34 11	27 2	20 11	3,027,976	3,403,072	1,164,361
1915	52 10	37 4	30 2	3,225,198	3,552,128	1,181,480
1916	58 5	53 6	33 5	3,600,391	2,182,218	1,129,096
1917	75 9	64 9	49 10	2,386,196	2,416,966	823,072
1918	72 10	59 0	49 4	2,484,210	1,870,761	4,483,313

TABLE VI.—*Annual and Septennial Average Prices per Bushel of* British Corn *in the Years* 1914—1918, *with the Value of* £100 *of Tithe Rent-charge.*

Years	Annual average price						Septennial average price						Value of tithe rent-charge of £100					
	Wheat		Barley		Oats		Wheat		Barley		Oats		Calculated on annual average			Calculated on septennial average		
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
1914	4	4¼	3	4¾	2	7¼	4	2	3	4¼	2	4¾	80	16	8¼	77	1	4¼
1915	6	7¼	4	8	3	9¼	4	6½	3	6¾	2	7¼	116	7	2¼	83	2	6¾
1916	7	3½	6	8¼	4	2	4	11	4	0¼	2	10½	141	8	9½	92	1	0¼
1917	9	5½	8	1	6	2¾	5	8½	4	9¼	3	5½	188	9	7½	109	3	11
1918	9	1¼	7	4½	6	2	6	5¼	5	4	4	0	180	1	6½	109	3	11[1]

[1] As fixed by the Tithe Act, 1918.

[Continued from page 163.]

at 57*s.* 7*d.* per Imperial quarter at the end of 1917, fluctuated considerably from week to week, the provision allowing for a charge of 3*s.* extra for grain sold for manufacture being doubtless responsible for this. The highest weekly average was 62*s.* 6*d.* in the latter part of August. The Order of the Food Controller already referred to, then limited the price for the 1918 crop to the equivalent of 59*s.* 9*d.* per Imperial quarter, and the recorded prices then became fairly constant at about 60*s.* 3*d.*, rising in December to just over 62*s.* The resultant yearly average was 59*s.*, which is 5*s.* 9*d.* below the record of 1917, and 32*s.* above the average of the five pre-war years 1909-1913.

The price of **Oats** opened at 45*s.* 5*d.* and rose quickly to 52*s.* 3*d.* at the end of February. It then declined to 44*s.* 9*d.*, which was recorded in the week ending June 1st, and after a period of vacillation rose rapidly to the high figure of 57*s.* 11*d.* at the end of August. The figure then fixed for the grain harvested in 1918 was about 45*s.* per quarter, and the price accordingly fell. An additional 3*s.* per quarter was, however,

[Continued on page 172.]

TABLE VII.—*Monthly Average Prices of* Fat Stock *and* Milking Cows *in England and Wales during the Year* 1918.

(Compiled from the Return of Market Prices published weekly by the Board of Agriculture and Fisheries.)

DESCRIPTION.	Grade	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
		Per cwt. live weight												
FAT CATTLE:		*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Polled Scots	1	75 0	75 4	75 5	75 3	75 2	75 2	75 3	75 3	75 5	75 4	74 10	77 1	75 4
	2	70 0	70 0	70 1	70 0	70 0	70 6	70 0	70 0	70 0	70 1	70 3	72 6	70 3
Shorthorns	1	75 0	75 0	75 2	75 2	75 2	75 0	75 2	75 1	75 1	75 0	74 9	76 8	75 2
	2	70 0	70 0	70 0	70 0	70 0	69 11	69 11	70 1	70 0	70 0	69 10	71 7	70 1
Herefords	1	75 0	75 1	75 3	75 5	75 4	75 4	75 3	75 4	75 5	75 2	74 11	76 2	75 4
	2	70 0	70 1	70 0	70 2	70 1	70 0	70 0	70 1	70 0	70 0	69 10	71 7	70 2
Devons	1	75 0	75 0	75 0	75 3	75 2	75 2	75 6	75 3	75 2	75 2	74 9	77 0	75 3
	2	70 0	70 0	70 1	70 2	70 0	70 1	70 0	70 0	69 10	70 1	69 9	71 8	70 2
Fat Cows	1	70 0	70 0	70 0	70 0	70 0	69 11	70 0	70 0	70 0	70 0	69 11	71 9	70 2
	2	62 0	62 0	62 0	62 1	62 2	62 1	61 11	62 1	62 1	62 1	62 0	63 8	62 2
	Quality	Per head.												
MILKING COWS:		*£ s.*	*£ s.*	*£ s.*	*£ s.*	*£ s.*	*£ s.*	*£ s.*	*£ s.*	*£ s.*	*£ s.*	*£ s.*	*£ s.*	*£ s.*
Shorthorns—														
In Milk	1	55 0	54 14	52 10	51 12	50 2	49 6	51 3	53 4	53 18	56 19	58 4	58 5	53 15
	2	43 9	42 19	40 17	39 11	38 12	38 2	39 6	41 6	41 16	44 16	46 0	45 4	41 16
Calvers	1	51 4	49 12	47 10	47 7	45 7	45 13	47 18	50 8	49 3	50 11	50 18	50 11	48 17
	2	41 0	39 7	37 7	37 2	35 19	37 1	37 16	39 14	39 17	40 11	40 19	40 12	38 19
Other Breeds—														
In Milk	1	50 6	50 16	48 15	46 4	50 3	44 3	45 7	47 2	47 2	52 5	50 10	51 17	48 14
	2	38 3	39 7	34 17	37 6	36 16	35 11	36 13	37 17	36 7	40 6	40 5	42 18	38 0
Calvers	1	—	—	33 0	29 0	37 0	32 10	35 0	—	42 0	—	—	33 0	34 10
	2	—	—	27 15	26 10	30 5	27 0	33 10	—	37 10	—	—	31 12	30 12
		Per lb.												
VEAL CALVES	1	*d.* 17¼	*d.* 17¼	*d.* 18	*d.* 18	*d.* 17	*d.* 16½	*d.* 16¾	*d.* 14¼	*d.* 12	*d.* 12¼	*d.* 12	*d.* 12½	*d.* 15¼
	2	15½	15¾	16½	15¾	14½	14¼	13	12½	10¾	10½	11	11	13½
FAT SHEEP:														
Downs	1	18	18¼	16	15¾	15¾	15¼	15¼	15¼	15½	15½	15¾	16¼	15¾
	2	17¼	16¼	16	15¾	15¾	15¼	15¼	15¼	15½	15½	15¾	16¼	15¾
Longwools	1	17¾	16½	15¾	15¾	15¼	15	15¼	15¼	15½	15¾	16	16½	15¾
	2	17	16½	15¾	15¾	15¼	15	15¼	15¼	15½	15¾	16	16½	15¾
Crossbreds	1	18	16¼	16	16	15½	15¼	15¼	15¼	15½	15½	16	16¼	16
	2	17¼	16¼	16	16	15½	15¼	15¼	15¼	15½	15½	16	16¼	15¾
		Per score live weight.												
FAT PIGS:		*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Bacon Pigs	1	18 0	18 0	18 9	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	20 4
	2	18 0	18 0	18 3	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	20 3
Porkers	1	18 0	18 0	19 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	20 4
	2	18 0	18 0	18 3	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	21 0	20 3

TABLE VIII.—*Yearly Average Prices of* **Fat Stock** *and* **Milking Cows** *in England and Wales during the Years* 1909 *to* 1918.

(Compiled from the Weekly Return of Market Prices.)

DESCRIPTION.	Quality	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
FAT CATTLE:		per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.
Polled Scots.	1	8 5	8 9	8 5	9 3	9 3	9 4	11 10	13 11	18 3	
	2	7 11	8 3	7 11	8 8	8 9	8 11	11 2	13 3	17 2	
Shorthorns	1	8 2	8 7	8 2	9 0	9 0	9 2	11 9	13 8	17 9	
	2	7 5	7 9	7 5	8 1	8 3	8 5	10 9	12 6	16 3	
Herefords	1	8 5	8 9	8 5	9 2	9 3	9 3	11 10	13 9	17 7	16 8[1]
	2	7 8	8 1	7 8	8 5	8 7	8 8	10 8	12 7	16 3	
Devons	1	8 5	8 9	8 4	9 0	9 2	9 2	11 11	13 7	17 6	
	2	7 9	7 11	7 7	8 1	8 3	8 5	10 10	12 1	16 0	
MILKING COWS		per head £ s.	per head £ s.	per head £ s.	per head £ s.	per head £ s.	per head £ s.	per head £ s.	per head £ s.	per head £ s.	per head £ s.
Shorthorns—											
In Milk	1	21 7	22 3	22 2	22 1	23 15	23 13	26 6	34 5	45 3	53 15
	2	17 18	18 9	18 7	18 8	19 15	19 15	21 14	27 10	35 14	41 16
Calvers	1	21 0	21 11	21 11	21 18	22 16	22 9	24 18	32 19	42 2	48 17
	2	17 16	18 5	18 0	18 2	19 4	18 19	20 15	26 13	33 15	38 19
Other Breeds—											
In Milk	1	18 13	19 12	19 2	19 2	20 16	21 0	24 4	31 8	44 6	48 14
	2	14 12	15 14	16 6	16 2	17 13	17 14	19 16	25 7	34 2	38 0
Calvers	1	14 11	16 1	14 12	16 9	16 9	17 4	19 0	24 1	29 9	34 10
	2	13 2	12 19	12 17	13 6	14 13	15 8	17 13	21 15	26 17	30 12
		per lb. d.	per lb. d.	per lb. d.	per lb. d.	per lb. d.	per lb. d.	per lb. d.	per lb. d.	per lb. d.	per lb. d.
VEAL CALVES	1	8¼	8½	8½	8½	9½	9¼	10½	12¼	16	15¼
	2	7½	7¾	7½	7½	8½	8½	9½	11	14¼	13½
FAT SHEEP:											
Downs	1	7½	8¼	7¾	8¾	9¼	9¾	11	13¼	16½	15¾
	2	6½	7¼	7	8	8½	8¾	10	12	15	15¾
Longwools	1	6¾	7¾	7¼	8¼	9	9¼	10¼	12½	15½	15¾
	2	6	6¾	6½	7½	8	8¼	9¼	11¼	14¼	15¾
Crossbreds	1	7¼	8¼	7¾	8¾	9¼	9¾	11	13¼	16½	16
	2	6½	7½	7	7¾	8½	8¾	10	12	15	15¾
FAT PIGS:		per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.	per stone s. d.
Bacon Pigs	1	7 1	7 10	6 8	7 4	8 5	7 10	9 7	12 4	16 7	
	2	6 7	7 5	6 2	6 10	7 11	7 4	9 0	11 7	15 9	
Porkers	1	7 6	8 4	7 3	7 8	8 11	8 4	10 0	13 2	17 2	19 0
	2	7 0	7 10	6 9	7 2	8 4	7 11	9 6	12 6	16 5	

[1] Controlled price.

TABLE IX.—*Quantities and Values of* Imports *of the principal* Agricultural Commodities *into the United Kingdom in* 1917 *and* 1918, *with the average for the Years* 1911 *to* 1913.

Commodities.	Quantities.			Values.		
	Annual Average, 1911-13	1917	1918	Annual Average, 1911-13	1917	1918
	Cwt.	Cwt.	Cwt.	£	£	£
GRAIN AND MEAL.						
Wheat	104,506,143	91,435,006	58,029,710	43,068,074	84,506,598	53,167,786
Wheat Meal and Flour	10,774,254	14,339,782	26,559,600	5,714,429	18,469,502	35,526,683
Barley	22,370,321	9,138,500	5,025,200	8,071,609	8,967,855	5,426,012
Oats	18,245,367	12,621,700	10,934,700	5,800,459	11,557,746	11,478,674
Oatmeal (including Groats and Rolled Oats)	845,693	2,291,387	2,908,429	602,913	3,864,529	4,842,330
Peas	2,249,705	1,284,990	2,180,495	1,103,733	2,473,034	5,405,696
Beans (other than Haricot	1,275,416	905,087	438,511	471,456	883,513	641,802
Maize	43,878,207	25,008,918	14,751,177	12,692,064	20,385,915	13,930,365
Maize Meal	581,982	1,666,567	1,428,465	215,885	1,968,611	1,616,990
MEAT.						
Beef	8,879,065	7,723,094	9,579,470	15,964,027	35,349,247	52,589,567
Mutton	5,358,482	2,620,314	2,129,239	10,331,026	10,736,205	9,579,170
Pork (including Bacon and Hams)	6,340,225	7,913,917	12,143,676	19,781,848	49,669,105	104,198,189
Unenumerated (including Rabbits)	1,498,563	1,297,327	1,496,982	3,034,851	5,862,886	7,428,813
TOTAL DEAD MEAT	22,076,349	19,573,552	25,349,367	49,112,752	101,617,443	173,795,739
BUTTER	4,148,958	1,806,516	1,614,625	24,679,478	18,895,707	20,225,917
CHEESE	2,318,231	2,946,066	2,357,822	7,196,490	19,462,390	15,910,041
MILK, CONDENSED	1,209,964	1,636,387	2,584,757	2,141,134	6,321,798	12,516,300
	No. of Great Hundreds	No. of Great Hundreds	No. of Great Hundreds			
EGGS	19,907,633	4,922,402	2,656,415	8,620,894	5,067,302	4,621,629

[Continued from page 169.]

still allowed for oats sold for oatmeal, &c., and this, combined with the sale of old corn, kept the price up. A sliding scale was also arranged by which prices rose 6*d.* per month, but the highest recorded figure (51*s.* 6*d.*) is in October. The average price realised during the year was 49*s.* 4*d.*, which is only 6*d.* less than that of 1917 and is over 30*s.* above the average of 1909-1913.

The septennial averages of corn prices (Table VI.), which form the basis for the calculation of tithe rentcharge, naturally showed a further increase with the inclusion of another war year (1918) in place of a pre-war year. By the provisions of

the Tithe Act, 1918, however, the value of tithe rentcharge has been fixed so as to remain until the 1st January, 1926, at the amount ruling in 1918, *i.e.*, the figure ascertained in January, 1918, on the basis of the average corn prices in the seven years 1911-17. The amount in question is 109*l.* 3*s.* 11*d.* per 100*l.* nominal tithe rent, and tithe rentcharges will consequently remain on this basis during the next seven years. As noted last year 109*l.* 3*s.* 11*d.* is the highest value since 1879, and is nearly 50 per cent. above the average ruling during 1910-14.

Live-stock prices, like those for corn, have been controlled throughout the year, and Table VII. consequently shows little variation from month to month. In the case of **Fat Cattle**, a uniform price of 16*s.* 7*d.* per stone dead weight was enforced, rising in December to 17*s.* 2*d.* The table shows the prices per cwt. live weight, and variations are therefore observable owing to the varying condition of the beasts. The average price for the year in the terms of dead weight per stone is 16*s.* 8*d.*, which is only a few pence above that for 1917, and about 8*s.* above the average of the prices ruling in 1911—13.

Milking Cows opened somewhat lower than the figures for December, 1917, and prices fell until June, when a steady rise set in, which resulted in high closing prices.

Shorthorns in milk reached 58*l.* 5*s.* per head in December, which is 51*s.* above the corresponding month in 1917, and 33*l.* 16*s.* in excess of the figure for December, 1913. The averages for the year show increases in the price of Shorthorns of 5*l.* 2*s.* in second quality cows, and 8*l.* 12*s.* in first quality cows in milk. Calves of this breed increased 5*l.* 4*s.* and 6*l.* 15*s.* respectively. In the case of other breeds the smallest increase is 3*l.* 15*s.* in second quality calves, and the largest 5*l.* 1*s.* in first quality calves.

The prices of **Veal Calves** were in January somewhat above those ruling in December, 1917, and in March and April rose to the high level of 1*s.* 6*d.* per lb. first quality. They then declined considerably, the lowest price recorded, 1*s.*, being registered in September and November. The average prices for the year for both qualities were $\frac{3}{4}d.$ below those of 1917, but were about 6*d.* above the average for 1911—13.

Fat Sheep prices were very high in January, but soon dropped to a fairly constant level. The average for the year was 1*s.* $3\frac{3}{4}d.$ per lb., except in the case of first quality Crossbreds, where it was $\frac{1}{4}d.$ higher. It is noticeable that the control of prices has resulted in a uniformity in the yearly average for all breeds and qualities. The figures are on the average equal to those of 1917, and from $7\frac{1}{4}d.$ to $8\frac{3}{4}d.$ higher than the average for 1911—13.

The controlled price of **Fat Pigs** for the first two months of the year was 18*s.* per score live weight, which was altered to 21*s.* in the middle of March. The average for the year, therefore, is 20*s.* 3*d.* or 20*s.* 4*d.* per score, which is the equivalent of about 19*s.* per stone dead weight. This is from 1*s.* 10*d.* to 3*s.* 9*d.* above the figure for 1917, and from 11*s.* to 12*s.* in excess of the average for the three years immediately prior to the war.

Wool. No figures can be given again this year, owing to the whole clip being commandered by the Government. The prices paid by them were, however, fixed at 60 per cent. above those for 1914, this being an increase of 10 per cent. over the prices given in 1917.

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THE WEATHER OF THE PAST AGRICULTURAL YEAR.

THE weather changes experienced during the agricultural season of 1917-18, were sufficiently varied to remind even the most unobservant town dweller of the farmer's helplessness in the face of circumstances over which he has practically no control. The opening months were, upon the whole, of a fairly normal description, the early part of the winter being cold, with occasional severe frosts and snowstorms, while the latter part was unusually mild. Harsh inclement conditions in the early spring checked, and more than checked, the rapid growth of vegetation which was in progress in February, and a long spell of cold dull weather in April was repeated in June, the latter month being further distinguished by an abnormal prevalence of ground frosts. In the early summer time the crops were decidedly backward, pastures were scanty, and fruit trees had received a series of shocks from which they never entirely recovered. Later on the weather became more propitious and vegetable growth proceeded briskly, but in July much damage was occasioned by heavy thunderstorms, accompanied in many instances by torrential falls of rain and hail. In August the weather was highly favourable for the rapid ingathering of the wheat crop in the more southern districts. In the north, when the harvest time arrived, all such operations were terribly hindered by one of the wettest Septembers on record, and much of the grain was irretrievably damaged. Better weather was experienced in October, but the early autumn was distinguished by an absence of drying winds,

so that the ground remained in too soddened a state to permit of its rapid clearance, and the preparation of the soil for the planting of the winter crops.

The Winter of 1917-18.

From a meteorological standpoint, the winter of 1917-18 resolved itself, as we have already seen, into two clearly marked periods, the first half of the season being cold, but dry, the second half unusually mild, and, in fact, at times almost springlike. The sharp frosts of December and January were not without their ordinary salutary effect, but farm work was, of course, in most districts at a practical standstill. Later on vegetation awoke abruptly from its long sleep, and for the remainder of the season there was little to check the growth of plant life, or to interfere in any way with the progress of spring sowing and other farm work.

December opened with cold weather, a sharp frost being experienced in the north on or about the 4th, and more generally about the 10th or 11th. At the close both of the first and second weeks the air became temporarily very mild, the thermometer on each occasion rising above 50° in many places, and reaching on the 6th a maximum of 58° at Ruthin. Strong Northerly gales swept over the country, however, on the 16th and 17th, the wind attaining, in gusts, a velocity of 60-70 miles an hour in nearly all districts, and reaching 76 miles at Aberdeen, 78 miles at Valencia (Co. Kerry); and no less than 96 miles in the Scilly Islands. The polar current brought with it a rapid fall of temperature, and between the 17th and 22nd a hard frost prevailed very generally. Over eastern and central England the thermometer on or about the 19th fell at least 15° below the freezing point, the lowest shade reading reported being one of 11° (21° of frost) at Worksop, Kingston-on-Soar, Woburn, Marlborough and Wokingham. Heavy rains fell in Ireland and North Wales on the 15th to 16th, and severe snowstorms occurred in some of the northern districts on the 19th, the soil around Perth being covered to a depth of more than 6 inches. In spite of the generally unsettled state of the weather, there were in December many fine intervals of considerable length, and at a number of places in the south and east of England the total duration of bright sunshine for the month was the largest observed since recording instruments were started in 1881.

The earlier half of January was exceedingly cold and changeable. On the 6th and 7th, another severe Northerly gale swept over the country and snow again fell in nearly all districts, the arrival of the strong polar current being accompanied, as in the earlier instance, by a frost of considerable

severity. On the 8th the thermometer in many parts of England failed to reach the freezing point all day, and in the course of the ensuing night it sank below 15° at several spots in the eastern and midland counties, and reached 11° at Halstead. A still sharper frost occurred about the 14th or 15th, when the sheltered thermometer fell below 10° over practically the whole of the northern and central parts of Great Britain. At the English stations the lowest temperatures recorded were 3° at Bellingham, and 6° at Chopwellwood (Durham), Scaleby and Burnley, while in Scotland it went much lower, readings a trifle below zero being reported in many places. On or about the 13th the Scottish Dee is reported to have been frozen over for the first time since the great frost of February, 1895. The change to milder weather which afterwards took place originated with the arrival off our western coasts on the 15th of a deep storm system from the Atlantic. As this disturbance advanced a strong Southerly wind sprang up, and a heavy fall of snow was followed quickly in the south by still heavier rains, more than an inch and a half being measured in several parts of Kent and Sussex, and as much as 1·8 in. at Lyme Regis. By about the 18th the combined effect of this downpour and the rapid melting of the previous snow, resulted in heavy floods over a large portion of the western and southern counties ; at Penshurst, 40 sheep are said to have been washed away. For the remainder of January mild Southerly breezes were in the ascendant, the warmest weather occurring in most places on the 24th or 25th, when the thermometer rose a trifle above 55° in nearly all districts. On the 30th and 31st much fog spread over England from the North Sea, and on the latter date several fatalities occurred in the London area.

The open weather which had set in about the middle of January continued throughout nearly the whole of February, which proved in many districts the mildest on record for at least 30 years. A sharp frost occurred, however, between the 17th and 19th of the month, when the sheltered thermometer fell below 20° in many parts of our eastern, midland and southern counties and reached 15° at Wokingham. The warmest weather was experienced on the 22nd or 23rd, shade temperatures exceeding 55° being reported very generally, and a reading as high as 61° at Halstead. At the close of the month, a radical change was affected by a cyclonic disturbance which passed rapidly from north to south over Great Britain. During its progress a strong Northerly gale sprang up, the wind reaching, in gusts, a velocity of 70 miles an hour or more in several northern districts, and touching 76 miles at Southport. Snow squalls, resulting in some places in deep

drifts, were experienced in nearly all places ; and on Dartmoor the loss of ewes and lambs is reported to have been rather severe.

The opposing influences of a long period of cold in the earlier half of the winter, and an equally long spell of warmth in the latter half, were seen in a mean temperature which, for the season as a whole, was not widely different from the average. In the northern and eastern districts there was a slight excess of warmth, while in the south and south west there was a small deficit. Over the country generally the total rainfall was also in fair agreement with the normal, a rather large deficiency being however reported in the midland and south-western counties. The duration of bright sunshine was in excess of the average, and appreciably so in the east and south-east of England.

The Spring of 1918.

The spring of 1918 opened favourably enough, but can scarcely be said to have improved as time went on. A long period of fair dry weather in March proved encouraging to spring sowing and enabled farm work in general to proceed with little interruption. In April the weather was, however, mostly dull and cold, so that the growing crops made little real progress, the pastures, more especially, presenting at the end of the month an unusually bare appearance for the time of year. Later on the air gradually became warmer, but in the latter half of May a good deal of damage was done by thunderstorms, which were accompanied in very many localities by destructive falls of rain and hail. The widespread failure of so many of the fruit crops appears to have been due in a large measure to the ungenial weather of April, but according to many reports the orchards also suffered very severely from the attacks of insect pests, which appear to have been far more numerous and persistent than in many recent years.

March opened with cold North-Easterly winds, accompanied in many northern and eastern districts by occasional falls of snow. Sharp frosts occurred on the 1st and 2nd, and again on or about the 9th, the thermometer on each occasion falling in many places at least 10° below the freezing point. After about the 5th, no rain fell for periods ranging in various districts between a fortnight and three weeks, the days being mostly fine and sunny, but the nights cold, with now and then a sharp touch of ground frost. Between the 22nd and 24th a slight foretaste of summer was experienced, the thermometer in the shade rising to 70° or a trifle above it in most districts. At Worksop the maximum of 72° on the 24th was the highest temperature registered in March since 1876. After the last

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Rainfall, Temperature, *and* Bright Sunshine *experienced over* England *and* Wales *during the whole of* 1918, *with Average and Extreme Values for Previous Years.*

Districts	Rainfall: Total Fall				Rainfall: No. of Days with Rain			
		For 52 years, 1866-1917				For 37 years, 1881-1917		
	In 1918	Average	Extremes: Driest	Extremes: Wettest	In 1918	Average	Extremes: Smallest	Extremes: Largest
	In.	In.	In.	In.				
North-eastern	24·4	25·3	19·9 (1884)	37·2 (1872)	187	186	162 (1884)	208 (1894)
Eastern	26·5	25·0	19·1 (1874 and 1887)	33·1 (1872)	186	181	156 (1898)	205 (1894)
Midland	28·7	27·5	19·2 (1887)	39·8 (1872)	189	179	148 (1887)	210 (1882)
South-eastern	29·4	29·1	21·5 (1887)	41·7 (1872)	184	174	137 (1899)	197 (1882) and 1903)
North-western, with North Wales	39·0	37·6	24·9 (1887)	59·2 (1872)	204	200	163 (1887)	226 (1903)
South-western, with South Wales	40·5	41·7	28·3 (1887)	68·6 (1872)	205	199	159 (1887)	235 (1882)
Channel Islands[1]	30·6	32·9	26·2 (1887)	41·8 (1910)	203	210	169 (1899)	251 (1886)

Districts	Mean Temperature				Hours of Bright Sunshine			
		For 52 years, 1866-1917				For 37 years, 1881-1917		
	In 1918	Average	Extremes: Coldest	Extremes: Warmest	In 1918	Average	Extremes: Cloudiest	Extremes: Sunniest
	°	°	°	°				
North-eastern	48·2	47·5	44·8 (1879)	49·0 (1898)	1412	1342	1006 (1885)	1601 (1906)
Eastern	49·0	48·6	45·6 (1879)	51·0 (1868)	1567	1575	1267 (1888)	1864 (1899)
Midland	49·0	48·1	45·6 (1879)	51·1 (1868)	1372	1493	1156 (1912)	1715 (1893)
South-eastern	50·0	49·6	46·7 (1879)	51·4 (1898)	1645	1613	1245 (1888)	1983 (1899)
North-western, with North Wales	49·0	48·4	45·7 (1879)	50·3 (1868)	1438	1402	1198 (1888)	1683 (1901)
South-western, with South Wales	50·0	49·5	48·1 (1888)	52·8 (1868)	1629	1624	1294 (1912)	1964 (1893)
Channel Islands[1]	52·4	52·1	50·7 (1885)	54·3 (1899)	1968	1871	1636 (1913)	2300 (1893)

NOTE.—The above Table is compiled from information given in the Weekly Weather Report of the Meteorological Office.

[1] For the Channel Islands the "Averages" and "Extremes" of Rainfall and Mean Temperature are for the thirty-seven years, 1881-1917.

The Rainfall of 1918 *and of the previous Ten Years, with the Average Annual Fall for a long period, as observed at thirty-eight stations situated in various parts of the United Kingdom.*

Stations	1918		Rainfall of Previous Years										[1] Average rainfall
	Total rainfall	Difference from average	1917	1916	1915	1914	1913	1912	1911	1910	1909	1908	
ENGLAND AND WALES:	In.	Per cent.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In
Durham	22·6	— 3	26·0	27·2	26·0	25·9	23·4	29·2	23·0	24·9	24·8	19·4	26·8
York	25·4	+ 1	22·0	23·9	24·6	26·3	20·5	33·0	25·1	24·6	24·8	21·8	25·1
Norwich	28·9	+ 7	28·3	32·7	30·0	27·6	24·4	35·0	26·7	31·8	27·8	25·2	27·1
Yarmouth	24·8	— 2	25·5	27·7	32·8	27·2	22·6	33·6	20·4	28·5	24·2	22·5	25·3
Cambridge	25·4	+13	22·7	23·8	24·1	23·3	18·7	27·3	19·0	22·8	23·1	17·6	22·5
Rothamsted	27·6	0	27·6	31·7	32·4	27·4	22·0	33·6	27·6	29·7	26·8	23·4	27·7
Nottingham	21·9	—11	20·7	26·5	26·9	23·6	22·3	30·1	19·4	24·7	25·2	21·3	24·6
Cheadle	34·7	+ 6	33·9	34·2	34·5	37·7	31·2	38·9	23·8	36·5	37·7	33·3	32·6
Ross-on-Wye	23·7	—16	25·7	29·6	32·0	31·3	30·8	36·8	22·4	35·5	25·6	21·7	28 3
Coventry	25·2	0	25·3	28·6	28·9	25·2	26·4	37·0	21·4	29·6	26·7	23·1	25·2
Oxford	27·2	+ 8	24·9	31·4	31·5	29·5	25·2	32·5	20·9	28·9	27·5	23·9	25·2
London (Kew)	28·1	+17	28·3	29·9	32·9	27·1	21·9	28·0	23·1	25·5	23·7	22·2	24·0
Hastings	26·8	— 7	30·2	35·5	32·1	30·0	30·7	32·0	29·6	28·9	31·4	22·0	28·8
Southampton	32·2	+ 3	30·1	35·5	41·6	37·0	32·0	37·3	30·4	33·6	36·1	27·8	31·1
Stonyhurst	59·2	+25	44·5	49·2	42·4	50·1	42·1	54·1	44·2	53·3	48·8	48·3	47·2
Manchester (City)	44·3	+27	34·7	33·3	33·8	35·3	29·8	40·6	31·1	37·5	37·0	32·5	34·7
Liverpool	31·9	+11	30·6	24·9	26·8	26·0	25·9	30·2	25·3	28·6	28·4	28·9	28·8
Llandudno	30·7	— 1	26·6	29·9	33·2	31·3	31·8	33·0	30·5	36·7	32·0	30·8	30·9
Pembroke	37·3	+ 5	37·7	37·4	40·2	36·1	41·5	41·0	38·6	38·9	33·1	38·5	35·5
Clifton	41·6	+21	31·9	42·9	37·7	39·7	31·0	44·7	29·0	42·4	36·8	26·6	34·5
Cullompton	37·9	+ 8	32·5	44·6	40·0	41·9	37·4	47·8	35·0	46·8	34·4	27·5	35·1
Plymouth	37·4	+ 4	30·0	39·2	43·7	45·9	36·5	47·0	37·6	44·3	35·2	31·0	35·9
Scilly (St. Mary's)	32·5	— 2	31·9	38·8	33·8	34·3	34·8	36·5	34·2	36·6	27·0	24·7	33·1
Jersey (St. Aubin's)	28·1	—17	30·4	34·9	35·9	38·1	26·5	43·3	31·7	44·4	31·7	25·2	33·9
[2] Mean for the whole of England and Wales	31·3	+ 5	29·3	34·0	33·4	33·4	29·0	36·8	28·8	34·5	31·3	26·6	29·7
SCOTLAND:													
Stornoway	56·1	+15	50·5	49·0	46·0	50·0	47·0	54·7	48·3	53·0	46·2	52·6	48·6
Wick	32·2	+ 9	31·3	28·0	26·4	28·7	24·6	32·5	27·4	32·5	33·6	32·0	29·6
Aberdeen	29·4	— 4	28·2	35·6	32·4	28·7	23·8	29·3	27·5	27·7	30·4	28·0	30·7
Balmoral	31·3	—11	30·6	42·3	43·0	38·8	31·2	38·3	29·9	37·5	30·8	26·2	35·0
Leith	25·8	+ 7	21·1	37·5	25·9	21·1	17·9	25·3	19·9	25·8	27·1	22·1	24·2
Marchmont	28·0	—18	33·3	45·0	33·6	29·1	26·1	31·9	31·7	28·9	34·2	30·7	34·3
Fort Augustus	46·7	+ 5	43·6	59·8	32·9	42·4	45·5	50·3	44·8	42·2	37·4	43·9	44·4
Glasgow	40·5	+ 4	37·1	44·2	30·9	36·1	36·2	41·0	36·3	39·2	39·3	35·8	38·8
[2] Mean for the whole of Scotland	45·6	+ 4	43·8	48·7	38·5	38·5	40·4	45·4	41·7	43·2	41·8	43·1	43·8
IRELAND:													
Belfast	37·6	+10	36·2	37·4	36·2	35·0	37·7	44·7	36·3	40·6	35·7	38·7	34·1
Markree Castle	49·6	+16	51·3	55·2	46·6	47·3	45·7	49·1	42·3	53·5	40·7	47·3	42·6
Armagh	35·2	+11	34·6	37·0	29·2	32·1	35·1	35·8	27·6	32·5	28·9	33·1	31·8
Dublin	26·8	4	29·1	38·6	33·6	26·5	28·8	27·7	23·5	35·4	26·9	23·8	27·9
Birr Castle (Parsonstown)	34·9	+ 6	32·4	40·6	33·4	32·6	35·4	34·5	31·0	34·2	29·6	33·4	33·0
Kilkenny	36·0	+ 9	29·9	35·3	32·8	32·4	35·1	36·4	36·3	37·4	36·1	33·5	33·0
[2] Mean for the whole of Ireland	41·6	+ 6	37·6	42·9	38·8	38·8	41·9	41·0	36·5	41·0	35·3	39·2	39·3

[1] The Average Fall is in nearly all cases deduced from observations extending over the forty years 1876-1915.

[2] The Mean Rainfall for each country is based upon observations made at a large number of stations in addition to those given above.

[Continued from page 177.]
mentioned date a cold Northerly wind sprang up, and in the course of the next two or three days squalls of snow were experienced in the north and east. In some parts of the eastern and midland counties the maximum temperature on the 25th was nearly 20° lower than on the previous day.

Under the influence of winds blowing mainly from a Northerly or Easterly quarter the cold weather which had set in at the end of March continued throughout the greater part of April. Over north Britain some very sharp frosts occurred about the 15th or 16th, the thermometer in Central Scotland falling at least 10° below the freezing point. Over the major part of England the coldest weather occurred between the 19th and 21st, and was less severe than in the north, few places reporting a screened temperature more than 5° or 6° below freezing. In the eastern and south-eastern counties the effect of the polar winds was accentuated by an unusual amount of dull weather, and by occasional heavy falls of rain, the month proving in some places the wettest April for at least 40 years. One of the largest individual downpours occurred on the 15th, when amounts exceeding $1\frac{1}{2}$ inches were reported in several parts of eastern England, and as much as 1·9 inches at Little Massingham, in Norfolk; between that date and the 21st the rain was mingled, not infrequently, with snow or sleet. Towards the close of the month the weather became more genial, and between the 25th and 27th the maximum shade temperature exceeded 65° in most districts, and touched 70° at a few places in the west.

In the earlier half of May the conditions were mostly cool again and very unsettled, and at various times between the 1st and 11th most places experienced at least one or two ground frosts of sufficient intensity to cause damage to the fruit blossoms and to some of the low lying crops. After the middle of the month the air became much warmer, and with the exception of two thundery spells, one on or about the 17th, the other between the 21st and 23rd, the weather was for the most part bright and sunny. The storms which occurred at the times mentioned were accompanied in many localities by destructive falls of rain and hail, the stones being described locally as of the "size of big marbles" or "as large as pigeon's eggs." The damage done by hail on the 17th appears to have been especially noticeable in the home and midland counties; at Fulbeck and Great Missenden (Bucks), the rain collected during the storm was not far short of 3 inches, and at Woburn it was a trifle above that amount. On the 21st or 22nd a burst of summer heat was experienced, the shade temperature rising to between 80° and 85° in most parts of England and touching 86° at Reading. In many localities the readings on

the 22nd were the highest recorded in May for at least 30 years ; on the following day, when a sudden change of wind occurred, the thermometer failed to rise to within 20° of the level it had reached only 24 hours earlier.

For the spring as a whole the mean temperature was above the average, but over southern England the excess was small. Rainfall was about equal to the normal in the midland and southern counties, and considerably above it in the east ; in the western districts it amounted to little more than three-fourths of the average. Bright sunshine was more than usually prevalent excepting in the Midlands, where the total duration agreed almost precisely with the normal.

The Summer of 1918.

The summer brought with it assortments of weather of so varied a description that few of the crops passed scatheless through the ordeals to which they were from time to time exposed. It opened with a long spell of cold Northerly winds, and as the rainfall was at the same time very deficient the progress of vegetation was exceedingly slow. Towards the close of June, the air became warmer, and for about a fortnight the crops received a stimulating amount of bright sunshine. After the middle of July there was a long period of thundery weather, the storms being accompanied in many places by torrential falls of rain and hail, which occasioned, locally, a good deal of damage in the fields and orchards. In August there was a fairly long run of fine warm weather, and in the earlier districts the wheat harvest was gathered quickly and under highly favourable conditions. Further north the appearance of showery weather at the close of August and heavy rains in September had a most deleterious effect upon nearly all the crops, and greatly delayed the commencement of the harvest.

June opened with an extremely short burst of heat, the thermometer on the 1st and 2nd exceeding 80° in several parts of England, and reaching 84° at Kensington. For the next three weeks or so the wind blew from points between West and North, and the weather was mostly harsh and dry, with an unusual prevalence of night frosts. Observations made during the past eleven years, show that upon an average no part of the country experiences in June more than one or two nights with ground frost. In 1918 several places reported at least seven such occasions, the number being as large as nine at Raunds (Northants) and Grayshott, ten at Tavistock, and twelve at Garforth. The coldest nights occurred about the 4th to 6th, the 16th to 17th, and the 25th to 26th ; at Raunds the exposed thermometer early on the 5th sank to a minimum of 20°. A

heavy fall of rain was experienced in Devonshire and South Wales on the 18th (as much as 1·6 in. at two of the Dartmoor stations, Sheepstor and Princetown), but upon the whole the month was exceedingly dry. In some parts of the Midlands, *e.g.* Nottingham and Belvoir Castle, the total rainfall was smaller than in any June of the past fifty years.

Towards the close of June a spell of fair weather of about a fortnight's duration set in, and on July 1st the thermometer in several parts of England rose slightly above 80°. The conditions afterwards became thoroughly unsettled, and for nearly three weeks the country experienced a long run of cool changeable weather, with frequent thunderstorms and heavy falls of rain and hail. The worst storms appear to have occurred about the 11th, the 16th to 17th, and the 22nd and 23rd; and in many places the number of thundery days was equal to more than three times the average for July, usually the stormiest of the three summer months. On the southern outskirts of London the storm of the 16th was accompanied by disastrous falls of hail. In nearly all districts the total rainfall for the month was considerably in excess of the average; the wettest weather occurring in the south-east of England, where more than double the usual quantity of rain was collected.

The southern and south-eastern portions of the London area were especially affected; at Greenwich the total rainfall for the month was more than three times the average, being greater than in any July of the previous 100 years, and, with one exception (in October, 1880), greater than in any other calendar month of the same extended period.

The first week in August proved warm and rather wet, and the last week cool and showery. On the 5th a heavy fall of rain occurred locally in the west and north, the amount in 24 hours being as large as 1·9 in. at Princetown and 1·8 in. at Darwen. At other times the weather of the month was fairly seasonable, but it was not until the end of the third week that any high summer temperatures were recorded. Over by far the larger portion of England the 21st and 22nd proved the hottest days of the entire summer, the thermometer in the shade rising to between 85° and 90° in a number of localities, and reaching 92° at Cambridge and 93° at Canterbury. The wind was at the time light from the Southward; on the 23rd, when a brisk Northerly breeze sprang up, the thermometer fell with unusual rapidity, the maximum readings for that day being in many instances from 20° to 25° lower than those recorded only 24 hours earlier. Very little thunder was reported in August, but on the 4th a storm of great severity passed over Margate, the accompanying rainfall being described of quite a torrential character.

For the summer as a whole the mean temperature was below the average, but in most districts the deficiency was slight, and in the north-east of England there was even a trifling excess. The total rainfall exceeded the average in the south-east, but was rather deficient elsewhere, more especially in the midland and north-eastern counties. At Nottingham less than half the usual amount was collected. The duration of bright sunshine was above the normal in South Wales and the south-west of England. In the Midlands it agreed almost precisely with the average, while in other districts there was a slight excess.

The Autumn of 1918.

The commencement of the autumn season was marked by a phenomenally wet September, which exercised so deleterious an effect upon harvesting operations that in many districts the corn which was cut in the first week was not gathered in until the close of the month, and then only in a sadly damaged condition. Owing to the excessive rainfall the pastures also lost much of their good quality, and in the northern districts the barley and oat crops showed serious signs of sprouting. Soon after the beginning of October the weather happily improved, but for the remainder of the season it was, as a rule, dull and damp, and often very foggy. The land therefore worked badly, and in nearly all districts the sowing of winter grain was seriously delayed. Statistics show that a wet autumn is seldom succeeded by a bounteous wheat harvest, and the agricultural prospects at the close of the year were therefore of none two favourable a character.

In addition to its abnormal rainfall, September was also, for the most part very cool, the only spell of genuine warmth occurring between the 5th and 7th of the month, when the thermometer in the shade rose a little above 70° in most parts of England and touched 75° at Manchester. During the first fortnight thunderstorms were very numerous (more so than in August), and on the 4th Salisbury was visited by a fall of hailstones as large as marbles, and coming with sufficient force to strip many trees of their foliage. Instances of a daily rainfall exceeding 1 in. were far too numerous to mention, and individual downpours of 2 in. or more were by no means infrequent. On the 11th the latter amount was surpassed at many places in the west and north, the day's fall being as large as 4·8 in. at Beddgelert and 4·6 in. at Douglas (Isle of Man). Over England and Wales as a whole the total rainfall for the month amounted to nearly two and a half times as much as the average, and was greater than in any September since that of 1896. With such conditions it is not surprising

to learn that the barometer was almost continuously very low, the winds being mainly from the Westward, and often very strong in force. The coldest weather occurred at the end of the month, the thermometer on the 29th and 30th remaining below 50° all day and in some places below 45° ; at Totland Bay (Isle of Wight), the 29th was the coldest September day shown by records extending over 32 years.

October was mostly damp and cheerless, but with a temperature differing but little from the average. The warmest weather occurred about the 6th or the 10th, the thermometer on the latter occasion rising to 65° or a trifle above it in several parts of the country. Slight frost prevailed on the night of the 4th, and sharper frosts on the 13th to 14th or between the 24th and 27th ; on the second occasion the thermometer on the grass fell below 20° at some of the more northern of the meteorological stations. The rainfall of the month was, as a rule, below the average,—very considerably so in the central and southern parts of England. Some heavy falls occurred, however, in the southern districts on the 3rd, and in the western districts on the 4th, and again on the 9th.

A mild air prevailed early in November, many places reporting on the 1st or 2nd a maximum temperature as high as 60°. After the first week a long spell of damp and rather cold weather was experienced, with frequent fogs in the eastern and central parts of England. On the north-east coast (at Tynemouth), fog was observed on no fewer than 15 days, the number being more than four times the average, and more than twice as large as in any November of the previous 22 years. Ground frosts were unusually frequent, the sharpest occurring between the 17th and 20th of the month, when the exposed thermometer fell below 20° in several inland parts of the country, and below 15° at some places in central Scotland. Towards the end of the month the weather became milder, and late on the 30th an exceptionally warm air extended over England from the southward.

For the autumn, as a whole, the mean temperature was below the average, the deficit being slight in the eastern counties but rather large in the north-west. Owing mainly to the very wet September the total rainfall was everywhere in excess of the normal, and especially so in the midland and north-western districts. Bright sunshine was deficient, the departure from the average being somewhat large in the east of England, but small in the north-western counties.

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NOTES, COMMUNICATIONS, AND REVIEWS.

The Society's Library.—It is probable that among the thousands of Members of the Royal Agricultural Society of England there are some who are not aware of the importance of the Society's library. This comprises about 13,000 books and 2,000 pamphlets ranging over a period of more than 300 years, and constitutes a valuable record of English agricultural work.

Early in 1917 the Council decided to overhaul the library and to make arrangements for the compilation of a proper catalogue. The work was entrusted to an expert, and by the end of 1918 the catalogue[1] had been completed and published.

It was in 1844 that the library was placed on a permanent foundation. In that year the Council "entered into a satisfactory arrangement with the executor of the late Mr. Webb Hall for the purchase by valuation of the library of the late Board of Agriculture bestowed upon his father at its dissolution." This was George Webb Hall, of Sneed Park, Gloucestershire, who had succeeded Arthur Young as Secretary to the Board. The books thus purchased had been got together chiefly, if not entirely, by the zeal and judicious selection of Arthur Young. Probably the letter-books and other manuscripts of the Board, now in possession of the Society, were acquired at the same time. Upon the basis thus created the Society began to build, and gradually enlarged its collection of agricultural literature. From time to time the library has been enriched by gifts, the most important being that of Sir Walter Gilbey in 1896 comprising a varied and valuable collection of books on agriculture which had been secured at the sale of Arthur Young's library. It included among other rare books more than 200 volumes of pamphlets dealing with agricultural, political and miscellaneous topics which Young had collected during his lifetime and had used as material for his own writings. Probably many of these pamphlets are unique, and they will be of considerable assistance to students of English agricultural and economic history.

A few observations on the earlier books may be of interest; and here it is as well to remark that the years in brackets are the dates of the editions in the library, which are not the first editions in all cases. Among the earliest books are *Petrus de Crescentiis* (1500) and *The Grete Herball* (1526), and the works of Thomas Tusser and Leonard Mascall. Tusser was 22 years of age when Mascall was born in 1546, but the earliest copy in the library of Tusser's *Five Hundred Points of Good*

[1] The price is 17*s.* 6*d.* to members and 1*l.* 1*s.* to non members.

Husbandry is the 1614 edition, while Mascall's *Booke of The Arte and Maner howe to Plante and Graffe all sortes of Trees*, is dated 1572. Tusser's style is that of a rhymester expressing in quaint verse many practical views on everyday matters not exclusively agricultural, as for example in *The Farmer's Daily Diet:—*

> "At Christmas play and make good cheer,
> For Christmas comes but once a year."

Mascall, on the other hand, is a more serious writer as well as an equally close observer, and he did good service to the farmers of his day by emphasising the advantages of the systematic treatment of live stock in his *Government of Cattel divided into the Government of Oxen, the Government of Horses and the Ordering of Sheep.* The library contains the first treatise on hops in the shape of Reynold Scot's *Perfite Platforme of a Hoppe Garden* (1576), the gardening books (1586) of Thomas Hill, who wrote under the name of "Didymus Mountain," and Barnaby Googe's *Foure Bookes of Husbandry* (1601). Of Sir Hugh Platt's works there are several, the earliest being his *New and Admirable Arte of Setting of Corne* (1600), which advocates dibbing in preference to broadcast sowing with the object of increasing the average yield of wheat from four quarters per acre to fifteen quarters. Gervase Markham follows Sir Hugh Platt in supporting the use of manure, and his *Farewel to Husbandry* (1631) strongly recommends salt and everything of a saline quality. Samuel Hartlib, the friend of Milton and pensioner of Cromwell, enumerates twenty-one kinds of manure in his *Legacie* (1651), and most, if not all, of his publications are in the library. *The Discourse of Husbandrie* (1652) was written probably not by Hartlib but by Sir Richard Weston, to whom belongs the credit of the first attempt to explain the cultivation of turnips. Walter Blith in his *English Improver Improved* (1652) is the first exponent of the science of drainage. John Worlidge, or Woolridge, is represented by several works, the earliest of which is his *Treatise of Cider* (1678). This outline of the older authors may be concluded by a reference to the *Horse-houghing Husbandry* (1731) of Jethro Tull, a man of great inventive genius as well as of scientific attainments.

As has been remarked in a recent review, the numerous pamphlets under the heading of "Provisions" show that the complaint of high prices is not a new cry to-day. These pamphlets range from 1764 to 1801.

The Society also possesses a complete set of the original quarto drafts of the Board of Agriculture Surveys, as well as the published octavo edition. We come now to Arthur Young. The entries under his name, extending from 1770 to 1815,

cover five pages of the catalogue ; and they form a monument of one of the most enlightened and useful pioneers of agricultural improvement. So much for the older books.

The modern works, though incomplete, are representative and valuable. There are numerous text-books, and these ought to be supplemented and kept up to date. The complete sets of stud books, herd books and flock books published by the British Breed Societies are an important feature. The publications of the United States Department of Agriculture cover eight pages of the catalogue, and the Arbeiten of the Deutsche Landwirtschafts-Gesellschaft ten pages. And the 79 volumes of the Society's own Journal in themselves form a reference library of practical and historical value.

The foregoing observations indicate that the Royal Agricultural Society of England possesses a valuable collection of books, and it is hoped that the present re-arrangement of the library will tend to stimulate students and to facilitate research.

F. Hamlyn Price.

The Work of the Seed Testing Station at the Food Production Department.—The Seed Testing Station was opened by the President of the Board of Agriculture and Fisheries on November 14, 1917. During the first season (8½ months), 7,744 samples were tested at the Station. The second season commenced on August 1 last, and by the end of March 18,500 samples had been received, so that it is probable that over 20,000 samples, or nearly three times as many as during the first season, will have been tested by July 30 next.

The majority of samples are sent by the seed trade for the purpose of obtaining the necessary particulars for making declarations as to purity and germination in conformity with the provisions of the Testing of Seeds Order. Seven hundred and seventy-two landowners and farmers, however, sent samples to be tested during 1917-18 ; whilst 2,262 have already availed themselves of the Station this season. The above figures are significant and show that even by the second season the Station's activities have become comparable to those of the long-established Continental stations.

A full report of the results of the tests conducted during the first season was published in the Journal of the Board of Agriculture for September, 1918, and a preliminary report on the tests conducted this season appeared in the February issue of that Journal.[1]

[1] "The Official Seed Testing Station at the Food Production Department of the Board—First Annual Report," *Journal Board of Agriculture*, Vol. XXV., No. 6, Sept., 1918 ; "The Quality of Farm and Garden Seeds," *Journal Board of Agriculture*, Vol. XXV., No. 11, February, 1919.

It is not necessary for the purpose of this review to again give the average germination and purity obtained for the various kinds of seeds or to give a detailed account of the impurities found in the several species. It may, however, be of interest to refer to some of the more important facts that the work conducted during two seasons have brought out—facts which are of considerable practical importance and which should be borne in mind when purchasing seeds.

Cereals. Over 12,000 samples of cereals have been tested since the Station opened. The results of this large number of tests have revealed that cereals are by no means always of high or even of reasonably good germinating capacity. It is, moreover, not at all easy to prognosticate the germination of seed grain by careful inspection of the sample. A large number of samples of wheat have been tested which might well have been passed as excellent seed grain, but which have germinated no more than 50 per cent. In the case of oats (other than black oats) and barley it is usually possible to detect by inspection whether a sample is of the highest class; but with samples that appear to be even slightly damaged the results of tests have proved that it is quite impossible to "guess" with any degree of certainty if a particular sample will germinate say 10 per cent. (quite worthless) or say 60 per cent. (of possible value), and in the case of samples which do not appear to be damaged but which would not be passed as highest-grade seed grain the germination may prove to be anything from about 70 per cent. to over 90 per cent. The germination test is therefore valuable not only as a means of rejecting worthless grain, but also as a guide to the amount of seed to be sown per acre. Cereal samples frequently contain large amounts of impurity; 8 to 10 per cent. of such weeds as wild radish and hemp nettle have been met with, whilst the majority of samples contain quite appreciable amounts of weed seeds.

About 4 per cent. of the wheat samples contained ear cockles;[1] samples from the western counties and Wales having been chiefly affected. Bunt[2] was very common and ergot[3] was found in nine of the wheat samples, whilst barley was often found to be contaminated with the spores of smut.

Clovers. The best germinations are usually given by Lucerne, foreign red clovers, crimson clover, and by alsike clover; whilst white clover, British red clovers, trefoil and sainfoin do not usually give such high figures.

Trefoil is a very deceptive seed in respect of germination. Tests at the Station have shown that quite nice looking samples

[1] Due to the eel worm *Tylenchus scandens.*
[2] Due to the fungus *Tilletia tritici.*
[3] Due to the *Claviceps purpurea.*

frequently germinate no more than 60 per cent. The seed is easily damaged internally and there is little doubt that it is frequently injured by the processes of "husking" and cleaning. Germination tests on trefoil have to be very carefully conducted; inexperienced analysts are likely to count seeds which are capable of swelling but incapable of growth as germinated. There is no seed upon which it is so important to have properly conducted tests made before reliance is placed on samples for sowing.

Of foreign clover seeds, those from Chile and North America usually contain the least impurity—whilst French clovers although less pure, are not as impure as British stocks. Chilian clover, usually however, contains dodder; over 80 per cent. of the Chilian samples tested at the Station having contained the seeds of this parasite. This renders Chilian clover "suspect" for use in Southern and Western counties, but in Scotland and in the North of England the presence of dodder in clover samples is of less significance.

Wild carrot is the worst weed in French samples; whilst cut-leaved cranesbill in red clover and soft cranesbills in white clover are the most characteristic weeds in British clovers. Soft cranesbill in white clover is perhaps the most difficult weed seed to remove from any samples, and it is much to be regretted that farmers do not take more trouble to grow clovers for seed from pure stocks and on clean land. It should be emphasised that although British clovers frequently do not germinate as well as imported seed they usually "stand" better and are less liable to clover sickness. Consequently a British red clover with a germination of about 70 per cent. may be as valuable to the farmer as a foreign one with a germination of over 90 per cent.

Grasses. Timothy on the average gives a decidedly higher germination than other grasses and since it contains a large number of seeds to the pound it is one of the cheapest of grass seeds. The ryegrasses and meadow fescue give higher average germinations than cocksfoot and crested dogstail. The meadow fescue on the market last season was in the main of very poor quality, but better supplies are available this season. Yorkshire fog and soft brome grass are still far too plentiful in samples of ryegrasses and in meadow fescue, quite 40 per cent. of the samples containing over 1 per cent. of these injurious weed seeds. Cocksfoot and Timothy are usually comparatively free from injurious weed seeds, the latter grass sometimes, however, contains excess of sheep sorrel and the caryopses of Yorkshire fog, while the former grass frequently contains not inconsiderable amounts of ryegrass, tall oat and other grass seeds. Soft crepis is the worst weed seed found in any quantity

in samples of crested dogstail, and care should be taken to obtain samples free from this impurity, since it is a weed that gains rapidly on prepared leys.

Roots and Vegetables. With the exception of mangolds and peas, the seeds of roots and vegetables have given as good or higher average germinations this season than last. English harvested garden peas are of poor quality this season, the average germination being but little over 60 per cent. and a considerable number of samples have been tested with germinations of less than 20 per cent. It may be said as a general rule that dwarf French beans and scarlet runner beans do not germinate as well as broad beans, and that turnip, swede, rape, and Brussels sprouts are likely to germinate better than cabbage, broccoli, garden kale, and cauliflower.

Storage of Seeds. A large number of samples have been tested which have shown evidence of having been attacked by mice and by mites; mangel samples in particular, held over from one season to another, appear to be very liable to be injured or totally ruined by mice.

It may be said in conclusion that samples of every kind of seed have been received at the station which have proved to be almost incapable of germination, and consequently, with seeds at their present high prices, it is to be hoped that farmers will avail themselves to an ever growing extent of the facilities offered them by the establishment of the Official Seed Testing Station.

R. G. Stapleden.

Agriculture at Oxford University.—In anticipation of an increased demand in Oxford for agricultural education suitable for the requirements of the prospective landlords, land agents and farmers, those interested in the subject arranged for a series of conferences in the course of last summer, in order that the whole subject might be thoroughly examined and a scheme framed to meet the requirements of the classes indicated. Hitherto a student of agriculture desiring to take a degree had the opportunity of offering the subject as one of the three in the Final Pass School, but it was felt that there was no proper relationship between agriculture and the other two subjects that a candidate might select. In addition to this disadvantage a student with a turn for agriculture only got into grips with his subject in his third year. Moreover, to be eligible for the final examination in the Pass School a candidate had to pass both in Responsions and in Moderations, and this implied considerable study of ancient languages and of other subjects which had no immediate bearing on rural economy. As an alternative to the Degree Course in

the Pass School it was possible for a candidate to study for the Diploma in Rural Economy which, however, was modelled to a large extent on natural science, whereas history and economics make a stronger appeal to a considerable number of students. While a diploma meets the requirements of certain classes of students, it was felt that at a University a degree is the appropriate goal to a course of study. It was therefore decided that a new avenue to the Degree should be created which would enable the candidate to escape Moderations and to proceed after Responsions to his special agricultural studies. On representations along these lines being made to the Hebdomadal Council a statute was drafted which has now received the sanction of Convocation. This enables a student to take his Degree in Agriculture by passing two examinations, the preliminary and the final. The preliminary examination embraces as compulsory subjects the Formation and Properties of Soil, and either a French or a German author. In addition to these two subjects a candidate must offer other two, and for this purpose he may make a selection between (*a*) the Principles of Cultivation, (*b*) Economics and History, and (*c*) the Elements of Physics, Chemistry and Biology. If, therefore, the student has a taste for natural science he will most likely select, as his two optional subjects, the Principles of Cultivation and the Elements of Physics, Chemistry and Biology; whereas if his inclinations lie along the line of economics and history he will naturally offer this group together with the Principles of Cultivation. Having surmounted the preliminary examination the candidate then proceeds to the final examination, which must comprise the principles of farm management, including crops, pastures and meadows, the breeding and feeding of live stock and farm accountancy. In addition to this main subject the student has to offer two others from amongst the following three: (*a*) Estate Management (including Agricultural Law and Land Agency); (*b*) the Economics of Agriculture (including costs of Production, Marketing and Co-operation): and (*c*) the History of the Development of Agriculture.

The course consists of lectures and laboratory work; the teaching of the classroom being in touch with practical agriculture by means of a farm of 355 acres which has been secured within two miles of Oxford and to which frequent visits are made.

Associated with the School of Agriculture is the Institute of Research in Agricultural Economics where a student has the opportunity of taking part in the routine work of cost accountancy. He may also, if qualified, assist in the economic investigations which the Institute undertakes. The School

of Forestry which occupies another part of the building, gives full opportunity for specialization in this important subject.

W. SOMERVILLE.

The Stud Stock Interests of Great Britain.—It has hitherto been the practice, more or less, to look upon this great interest from a sectional or a particular breed point of view. But under prevailing conditions it will be generally recognised that a comprehensive review of it is now both desirable and necessary. It is difficult to bring a subject of such world-wide ramifications into the confines of a briefly summarised article. We have roughly divided the question into three main sections. The industry being a national one, without question, in which every member of the community has a direct interest, it follows that the matter should be dealt with from a broad, national standpoint, not as has been the case in the past.

ORGANISATION.

Our first section deals with the present system of the organisation of the British stud stock interests. Briefly, it is comprised of a series of breed societies, dating back in foundation from 1854, and the whole of which are duly incorporated. The series of Tables found at the end of this section give the latest information procurable in connection therewith. The last one, Table V., places before the reader a set of figures which are entirely new, putting on record for the first time the total membership of these societies, and the number of animals individually recorded with their breed.

It is not the writer's intention to criticise the various rules and regulations governing the entry and record of the different Societies' Stud, Herd, or Flock Books. The time, however, has arrived when it should be emphatically stated that no animal exported for stud purposes ought to be sent out of the country until it has been individually entered and numbered in the records of its breed. It will doubtless be urged that there should be no interference in the management of any particular breed Society, from the point of view that those engaged in the management of the Associations are generally breeders, and consequently are the best judges as to what is or what is not necessary for the benefit of their breed.

Viewing the position from that narrow standpoint of each particular breed's interest, their contention is sound, but when the whole interest is properly considered as one of great national importance, it at once becomes obvious that it is the duty of some outside authority to state what regulations must be

enforced for the general benefit, however irksome they may appear to particular Societies.

Therefore, seeing that each Breed Society has acquired, by means of incorporation, rights guaranteeing its protection by the Government, it is only just that the authority that confers and exercises these rights should be placed in a position to enforce the complying with certain essential regulations in the interest of the Nation.

These essential regulations are : (1) That every stud animal exported should be individually identifiable, both as to its recorded number and as to its breeder ; and (2) that no animal should be exported from this country for stud purposes until it has been individually recorded in the Stud, Herd, or Flock Book of its breed. These are not impossible regulations, seeing that at least one or two Societies have already voluntarily made conditions to that effect. Two such regulations would convey a guarantee of the purity, &c., of the animal's breeding, and would give the purchaser abroad the certainty that he obtains the identical animal that was purchased on his behalf, in what has been rightly termed, "The Stud Farm of the World."

Breed Societies.

Table I.—*Horses.*

Name of Society	Established	No. of Members	Stud Books Published	No. of Males Recorded	No. of Females Recorded
General Stud Book Society .	—	1,600 (Owners)	—	—	—
Clydesdale Horse Society .	1877	3,259	41	19,591	44,441
Suffolk Horse Society . .	1877	500	21	4,868	9,999
Shire Horse Society . .	1878	5,476	39	35,335	19,102
Hackney Horse Society . .	1882	1,510	34	13,277	24,625
Cleveland Bay Horse Society .	1884	74	14	1,722	1,378
Hunters' Improvement Socty.	1885	1,800	17	204	6,264
Shetland Pony Stud Book Soc.	1890	380	—	898	3,632
Association for the Improvement of Breed of New Forest Ponies	1891	170	—	—	—
National Pony Society . .	1893	695	14	812	3,135
Welsh Pony and Cob Society .	1901	300	17	—	7,000
British Percheron Horse Soc.	1916	141	—	—	—
Dales Pony Improvement Soc.	1916	219	—	12	190
Thoroughbred Breeders' and Trainers' Association . .	1917	1,900	—	—	—
Arab Horse Society . .	1918	155	—	—	—

N.B. No information obtainable from the British Trotting and Galloway Stud Book Society, and the Association of Race Horse Owners, Breeders and Trainers.

TABLE II.—*Cattle.*

Name of Society	Established	No. of Members	Herd Books Published	No. of Males Recorded	No. of Females Recorded
Sussex Herd Book Society	1854	175	33	4,552	17,814
Shorthorn Society	1874	2,300	68	140,292	—
Ayrshire Cattle Society	1877	822	41	18,743	78,818
Galloway Cattle Society	1877	220	39	14,010	26,782
English Jersey Cattle Society	1878	562	29	12,816	37,916
Hereford Herd Book Society	1878	578	49	35,783	—
Aberdeen-Angus Cattle Society	1879	600	43	44,903	63,799
English Guernsey Cattle Soc.	1884	260	34	3,626	13,214
Devon Cattle Society	1884	306	42	10,418	31,590
Red Poll Society	1888	230	36	11,538	27,405
South Devon Herd-Book Soc.	1891	631	18	7,509	19,270
English Kerry and Dexter Cattle Society	1892	112	18	1,001	4,543
Lincoln Red Shorthorn Assoc.	1895	395	24	14,145	11,277
Longhorn Cattle Society	1899	25	11	810	1,063
Welsh Black Cattle Society	1904	135	7	1,241	3,169
Dairy Shorthorn Association	1905	450	—	—	—
British Freisland Cattle Soc.	1909	850	7	5,500	18,000
Shetland Herd Book Society	1911	163	6	144	720

N.B.—No information obtainable from the Highland Cattle Society.

TABLE III.—*Sheep.*

Name of Society	Established	No. of Members	Flock Books Published	No. of Rams Recorded	No. of Ewes Recorded
Shropshire Sheep-Breeders' Association	1883	220	36	14,846	—
Suffolk Sheep Society	1886	421	32	858	—
Oxford Down Sheep-Breeders' Association	1889	193	30	9,270	3,241
Wensleydale Longwool Sheep-Breeders' Association	1889	68	29	1,601	—
Wensleydale Bluefaced Sheep Breeders' Association	1890	176	29	2,437	—
Hampshire Down Sheep-Breeders' Association	1890	403	29	16,155	3,187
Southdown Sheep Society	1890	292	26	11,571	5,963
Cotswold Sheep Society	1891	24	27	1,536	16,903
Dorset Down Sheep-Breeders' Association	1891	173	28	3,816	—
Lincoln Longwool Sheep-Breeders' Association	1892	229	27	15,250	—
Cheviot Sheep Society	1892	120	28	3,129	—
Leicester Sheep-Breeders' Association	1893	83	26	1,800	—
Kent or Romney Marsh Sheep-Breeders' Association	1895	155	24	44,179	10,001
Society of Border Leicester Sheep-Breeders	1898	425	—	4,749	—
Devon Longwool Sheep-Breeders' Association	1898	22	7	1,511	83

Name of Society	Established	No. of Members	Flock Books Published	No. of Rams Recorded	No. of Ewes Recorded
Kerry Hill (Wales) Sheep-Breeders' Association	1899	173	18	5,423	—
South Devon Flock-Book Association	1903	182	15	14,541	149
Lonk Sheep-Breeders' Assoc.	1905	40	10	322	1,057
Welsh Mountain Sheep Society	1905	52	10	919	—
Exmoor Horn Sheep-Breeders' Society	1906	148	12	819	20
Ryeland Sheep-Breeders' Association	1907	63	7	650	—
Dartmoor Sheep-Breeders' Association	1909	70	2	277	1,848
Herdwick Sheep-Breeders' Association	1918	106	1	600	—

N.B.—No information obtainable from the Dorset Down Sheep-Breeders' Association, the Derbyshire Gritstone Sheep-Breeders' Association, and the Black-Faced Sheep-Breeders' Association.

TABLE IV.—*Pigs.*

Name of Society	Established	No. of Members	No. of Herd Books Published	No. of Boars Recorded	No. of Sows Recorded
National Pig-Breeders' Assoc.	1883	489	35	25,827	57,714
British Berkshire Society	1884	200	35	21,133	—
Large Black Pig Society	1899	467	19	3,762	10,211
Lincolnshire Curly-Coated Pig-Breeders' Association	1907	100	11	2,041	5,698
Old Gloucester Spots Pig-Breeders' Society	1913	340	4	1,100	3,200
Cumberland Pig-Breeders' Association	1916	165	3	251	920
Old Glamorgan Pig Society	1918	25	—	3	9
Wessex Saddle-Back Pig Soc.	1918	58	1	64	236

TABLE V.—*Summary of Breed Societies.*

	No. of Societies	No. of Members	Animals individually Registered
A. Horse Societies	15	18,179	196,489
B. Cattle Societies	18	8,914	660,411
C. Sheep Societies	23	3,838	198,711
D. Pig Societies	8	1,844	132,169
	64	32,775	1,187,780

NOTE.—No information obtainable from A, two Societies; B, one Society; and C, three Societies. D—The Tamworth Society is included in the National Pig-Breeders' Association.

The Export Demand.

Thoroughly to test the value of the Stud Stock Interests to Great Britain, a series of tables have been drawn up, showing the result of the export demand during the past twenty-five years. In order to more readily ascertain the effect of the restrictions imposed necessarily during the war period, the summaries have been arranged into three quinquennial periods, and one quadrennial period at the end. The tables have been further divided into the animals exported to foreign countries, and those exported to British possessions, Tables B and D giving the aggregate of the foreign demand and the demand from the British possessions. The final Table E gives the aggregate total of the exports for the period of twenty-five years, together with the aggregate declared value, the average number exported annually, the average annual declared value, and the average value per head. These tables are believed to be unique in their way, more particularly Table E. The reader will have placed before him for the first time the record showing that during the past quarter of a century the average annual stud stock exports have reached a value of well over 1,000,000*l.*

We are informed upon good authority that it is the intention of the Board of Agriculture to continue the war regulation of making it needful to obtain a licence for the exportation of stud animals. Some old-fashioned breeders and exporters take strong exception to this wise and judicious provision of the authorities. In the writer's opinion, the continuance of this regulation is essential. It is particularly pointed out that by the licence regulation the Government is in a position to stop exportation in the event of the export demand becoming so large as to endanger the permanence of any breed. The tables given below show that the possibility of this being brought into effect is very very slight. But the tables referred to also show the absolute necessity of informing the Board of Agriculture, or whatever authority is in charge of the matter, of the actual sale value of the animals exported. It is all very well for interested parties to raise objections to what they are pleased to term this interference with their private affairs.

In many instances, the average values shown in the tables are considerably below what they should be. Therefore, under the system brought into being by the war, whereby the shipper of each lot of animals was required to furnish the Board of Agriculture with the actual purchase price of the animals to be sent abroad, the body mentioned is in a position to check the declared values given by the Custom authorities in their monthly Statement of Trade and Navigation, published for the country's information. Many years' experience shows

[Continued on page 200.]

TABLE VI.—*Live Stock Exports to Foreign Countries.*

HORSES.

Period	No. Exported	Declared Value	Average Yearly No. Exported	Average Yearly Declared Value	Average Declared Value per head
		STALLIONS.			
		£		£	£
1894—1900	3,073	358,224	439·00	51,174·85	116·57
1901—1907	4,894	748,753	699·14	106,964·71	152·97
1908—1914	4,653	855,228	664·71	122,184·00	183·81
1915—1918	936	334,249	234·00	83,562·25	357·10
1894—1918	13,556	2,296,454	542·24	91,858·16	169·40
		MARES.			
1894—1900	38,297	1,382,670	5,471·00	197,524·28	36·10
1901—1907	31,664	1 450,824	4,523·42	207,263·14	45·81
1908—1914	99,139	2,802,891	14,162·71	400,413·00	28·27
1915—1918	1,419	371,161	354·75	92,790·25	26·56
1894—1918	170,519	6,007,546	6,820·76	240,301·84	35·23
		GELDINGS.			
1894—1900	157,582	2,793,938	22,511·71	399,134·00	17·79
1901—1907	247,679	2,769,194	35,382·71	395,599·14	11·16
1908—1914	285,800	4,054,122	40.828·55	579,160·28	14·18
1915—1918	597	89,919	149·25	22,479·75	150·61
1894—1918	691,658	9,707,173	27,666·32	388,286·92	14·03
		TABLE A.—SUMMARY FOREIGN HORSE EXPORTS, 1894—1918.			
Stallions . .	13,556	2,296,454	542·24	91,858·16	169·40
Mares . .	170,519	6,007,546	6,820·76	240,301·84	35·23
Geldings . .	691,658	9,707,173	27,666·32	388,286·92	14·03
Aggregate . .	875,733	18,011,173	35,029·32	720,446·92	20·56
		CATTLE.			
1894—1900 A	17,983	551,223	2,569·00	78,746·14	30·65
1901—1907 A	13,093	887,669	1,870·42	126,809·85	67·61
1908—1914 B	5,270	573,626	817·14	81,946·55	100·28
1908—1914 C	7,132	257.752	1,018·88	36,821·71	36·14
1908—1914 D	1,289	24,959	184·14	3,565·55	19·36
1915—1918 B	4,445	670,860	1,111·25	167,715·00	150·92
1915—1918 C	2,876	176,762	719·00	44,190·50	61·46
1915—1918 D	641	19,182	160·25	4,795·50	29·92
1894—1918	53,179	3,162,033	2,127·16	126,481·32	59·45

N.B.—A, All sexes included. B, Bulls only. C, Cows and Heifers only. D, Calves only.

SHEEP.

Period	No. Exported	Declared Value	Average Yearly No. Exported	Average Yearly Declared Value	Average Declared Value per head
1894—1900	45,725	543,804	6,532·14	77,686·28	11·89
1901—1907	39,369	589,081	5,624·14	84,154·42	14·96
1908—1914	22,681	300,619	3,240·14	42,945·55	13·21
1915—1918	13,187	292,473	3,296·75	73,118·25	22·17
1894—1918	120,962	1,725,977	4,839·48	69,039·08	14·26
	PIGS.				
1894—1900	6,192	34,139	884·55	4,877·00	5·53
1901—1907	5,540	48,922	791·42	6,988·85	8·83
1908—1914	4,179	47,883	597·00	6,830·42	11·44
1914—1918	247	4,619	61·75	1,154·75	18·70
1894—1918	16,158	135,563	646·32	5,422·52	8·38
	TABLE B.—TOTAL LIVE STOCK EXPORTS TO FOREIGN COUNTRIES 1894—1918				
Horses (Table A)	875,733	18,011,173	35,029·32	720,446·92	20·56
Cattle . .	53,179	3,162,033	2,127·16	126,481·32	59·45
Sheep . .	120,962	1,725,977	4,839·48	69,039·08	14·26
Pigs . . .	16,158	135,563	646·32	5,422·52	8·38
Aggregate 1894—1918	—	23,034,746	—	921,389·84	—

TABLE VII.—*Live Stock Exports to British Possessions.*

HORSES.

Period	No. Exported	Declared Value	Average Yearly No. Exported	Average Yearly Declared Value	Average Declared Value per Head
	STALLIONS.				
		£		£	£
1894—1900	821	110,252	117·28	15,750·28	134·29
1901—1907	3,459	398,714	494·14	56,959·14	115·26
1908—1914	4,765	610,320	680·70	87,188·55	128·08
1915—1918	982	306,855	245·50	76,713·75	312·47
1894—1918	10,027	1,426,141	401·08	57,045·64	142·23
	MARES.				
1894—1900	1,314	82,062	187·71	11,723·14	62·45
1901—1907	4,633	299,670	661·85	42,810·00	64·68
1908—1914	7,473	529,518	1,067·55	75,645·42	70·85
1915—1918	1,020	186,771	255·00	46,692·75	183·10
1894—1918	14,440	1,098,021	577·60	43,920·84	76·04

GELDINGS.

Period	No. Exported	Declared Value	Average Yearly No. Exported	Average Yearly Declared Value	Average Declared Value per head
1894—1900	970	50,248	138·55	7,178·28	51·80
1901—1907	1,573	93,655	224·71	13,379·28	53·18
1908—1914	3,782	244,913	540·28	34.987·55	64·75
1915—1918	576	101,435	144·00	25,358·75	176·10
1894—1918	6,901	490,251	276·04	19,610·04	71·04

TABLE C.—SUMMARY BRITISH POSSESSIONS HORSE EXPORTS, 1894—1918.

Stallions . .	10,027	1,426,141	401·08	57,045·64	142·23
Mares . .	14,440	1,098,021	577·60	43,920·84	76·04
Geldings . .	6,901	490,251	276·04	19,610·04	71·04
Aggregate . .	31,368	3,014,413	1,254·72	120,576·52	96·09

CATTLE.

1894—1900 A	14,975	288,912	2,139·28	41,273·14	19·29
1901—1907 A	9,717	236,167	1,318·14	33,738·14	24·30
1908—1914 B	2,588	125,767	369·71	17,966·71	48·59
1908—1914 C	5,614	159,992	802·00	22,856·00	28·49
1908—1914 D	906	29,941	129·42	4,277·28	33·04
1915—1918 B	1,169	113,643	292·25	28,410·75	97·21
1915—1918 C	2,295	164,420	573·75	41,105·00	71·64
1915—1918 D	349	15,814	87·25	3,953·50	45·32
1894—1918	37,613	1,134,656	1,504·52	45,386·24	30·16

SHEEP.

1894—1900	9,704	56,418	1,386·28	8,059·71	5·81
1901—1907	11,866	94,075	1,695·14	13,439·28	7·09
1908—1914	12,804	95,979	1,829·14	13,711·28	7·49
1915—1918	2,333	29,446	583·25	7,361·50	12·62
1894—1918	36,707	275,918	1,468·28	11,036·72	7·51

PIGS.

1894—1900	625	3,829	89·28	547·00	6·12
1901—1907	1,373	13,864	196·14	1,980·55	10·09
1908—1914	784	8,585	112·00	1,226·42	10·95
1915—1918	407	2,822	101·75	705·50	6·93
1894—1918	3,189	29,100	127·56	1,164·00	9·12

TABLE D.—TOTAL LIVE STOCK EXPORTS, BRITISH POSSESSIONS, 1894—1918.

Horses (Table C)	31,368	3,014,413	1,254·72	120,576·52	96·09
Cattle . .	37,613	1,134,656	1,504·52	45,386·24	30·16
Sheep . .	36,707	275,918	1,468·28	11,036·72	7·51
Pigs . . .	3,189	29,100	127·56	1,164·00	9·12
Aggregate, 1894—1918	—	4,454,087	—	178,163·48	—

N.B.—A, All sexes included. B, Bulls only. C, Cows and Heifers only. D, Calves only

Total Live Stock Exports, 1894—1918.

Tables B and D together.

Description	Aggregate No. Exported	Aggregate Declared Value	Average Yearly No. Exported	Average Yearly Declared Value	Average Declared Value per head
		£		£	£
Horses . .	907,101	21,025,586	36,284·04	841,023·44	23·17
Cattle . .	90,792	4,296,683	3,631·68	171,867·56	47·32
Sheep . . .	157,669	2,001,895	6,306·76	80,075·80	12·70
Pigs . . .	19,347	164,663	773·88	6,586·52	8·51
	—	27,488,833	—	1,099,553·32	—

[Continued from page 196.]

that these figures, based upon some system that makes one year tally very well with another, have never given us the actual value of the animals exported. Had this been available, the writer is convinced that the average annual total of the declared value would probably be nearer two millions than one.

The Value of the Export Demand.

The third, and final, section is the natural result of the second section, namely, the inestimable value of the Stud Stock Export Trade to the country as a whole. Were it not for the high prices paid for the exported animals, the stud, herd, and flock owners of the country would be unable to maintain their stock in the present high degree of merit. Consequently, the failure of that export demand would, in a very short time, render the supply of animals available for our home breeders of considerably less value and merit. For every stud animal exported, there are left behind in the stud, herd, or flock from whence it came, ten or twelve animals not quite so attractive to the export buyer, but quite as good for breeding purposes, and these become available for service in the studs, herds, and flocks of ordinary commercial stock breeders.

It is one of those common fallacies prevalent among non-practical breeders, theorists, &c., that the stud stock breeders' sole object is to produce animals fit for sale abroad, and nothing further. The outline of the position, as given above, emphasises the incomputable value of these stud stock-breeding establishments in maintaining the high average quality of the stock of Great Britain.

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Tidal Lands—A Study of Shore Problems, by A. E. Carey, M.Inst.C.E., and Professor F. W. Oliver, F.R.S. Pp. 284 with 54 Illustrations. (Glasgow and Bombay, Blackie & Son, Limited. Price 12*s.* 6*d.*) This is a work which deals with sea erosion and accretion, and ought to appeal to every inhabitant of an island kingdom. It opens with an examination of natural maritime phenomena such as tides and currents, rain and rivers, scour and sediment, and proceeds to discuss quite shortly the artificial improvement of tidal waterways and the formation of sea walls and embankments. The legal aspect of the foreshore is then reviewed, in which connection it is stated, on the authority of the Office of Woods, that our coast line at high-water mark measures 7,906 miles, while the area between high and low water mark—the foreshore proper—covers 619,999 acres, a figure which suggests meticulous accuracy in the calculation! It is satisfactory to find, on the authority of the Director-General of Ordnance Survey, that in 33 years before 1896 there was a net gain of land in England of over 30,000 acres.

The shingle of our beaches is under constant motion. This is partly due to wind waves, and partly to tides, the lifting power of the water being often helped by the seaweed to which stones are attached. The stones of Chesil Bank for instance, are of the most varied origin, some from the chalk, some from the greensand, others from the Portland beds, while many are "far-travelled rocks of doubtful origin."

In a chapter introductory to the important part played by plants a useful account is given of the annuals and perennials. It is there stated that a crop of maize will take 244 tons of water from an acre of ground during the growing season. This is an obvious slip, the figure intended being probably 2,440 tons corresponding to about 24½ inches of water per acre, which is more in harmony with the exhaustive American, especially Wisconsin, experiments on the subject. The establishment of vegetation on bare foreshore is primarily a question of seed which is chiefly water-borne, though wind and animals also play a part in distribution. Whether the seed when it germinates will produce stable plants depends chiefly on the nature of the foothold for the resulting seedlings, and on their capacity to bear sea water. It is interesting to note that only about thirty species of British plants are able to endure immersion in sea water (true halophytes), the majority of seashore plants not belonging to this class. "Nevertheless the apparent recklessness and regardlessness of consequences with which non-halophytes carpet the ground right down to tidal limit are consistently characteristic of vegetation. It is largely conduced by the fact that the ripe seeds of plants of all kinds

are almost always impermeable to salt water, and being thus immune are liable to be distributed in good condition wherever the tide carries them. Should the ground in which the seeds are stranded be suitable for establishment it will invariably be occupied by the seedlings. This is only a single instance of the way in which vegetated areas push their outposts to the extreme available limits."

The sections which deal with the fixation of sand dunes and shingle beaches contain information of the highest value to those who have to handle such problems. In Great Britain dunes are met with chiefly on the east coast, notably in Norfolk, Suffolk, Essex, and in the neighbourhood of the Moray Firth in Scotland, though they are also present in North Wales and Cornwall, and other localities on the west coast. Many of such dunes are in a constant state of movement, the sand gradually encroaching on the land behind. The movement of such dunes can be impeded by the erection of barriers formed of dead material like brushwood, boards, &c., but their progress is best arrested by the establishment of living plants, notably Marram Grass (*Psamma arenaria*). This plant has a wonderful power of establishing itself on pure sand, and even if buried by sand drifts it rapidly finds its way to the surface again and forms a fibrous mass of rhizomes. Other plants of value in this connection are Lyme Grass (*Elymus arenarius*), Sea Holly, Spurge, Saltwort, and amongst shrubs are to be included Elder, Privet, Dog Rose, Creeping Willow, Blackberry, and Hawthorn. The Sea Buckthorn is also a shrub which withstands sea breezes and is largely used for fixing dunes. Of introduced species of trees, those that are most extensively used in fixing shifting sand on the Continent of Europe are the mountain pine, the Scotch pine, the common spruce, the white spruce, the common alder, and the birch. For planting on a commercial scale where timber rather than protection is the object, no tree surpasses in value the maritime pine, whose success in the south-west of France is a conspicuous example of what can be done under very unfavourable conditions. At Holkham in Norfolk the Corsican pine has proved very serviceable, while in other districts *Pinus insignis* and *Cupresses macrocarpa* have given good results. As regards the fixation of beach shingle, as contrasted with blowing sand, no plant has proved more useful than the *Suæda fruticosa*, a plant which is indigenous on several parts of our coast and one which revels in sea spray and in the unfavourable conditions associated with beaches. Like sea marram grass this plant appears to thrive best where it is frequently buried under shifting masses of material, having the power of regaining the surface under what would appear to be hopelessly unfavourable circumstances.

A chapter that will appeal to graziers is that which treats of the vegetation of salt marshes or "Saltings." Where such an area is only overflowed by spring tides the chief grass is *Glyceria maritima*, other plants with which it is usually associated being *Salicornia*, Sea Pink, Sea Plantain, Sea Lavender, Sea Spurrey, Sea Aster, and Sea Purslane. Land which is covered by every tide is either pure mud, or bears a sparse vegetation consisting chiefly of Marsh Samphire, Sea-weeds, and Grass-wrack (*Zostera*), the last being an important food of brent geese and other wild-fowl. A very interesting plant in this connection is *Spartinia Townsendii*, a grass first recorded from Southampton Water in 1870, but which has now established itself over large areas in other parts of the South of England. It has also been tried in more northern districts and promises to be a useful plant in reclaiming slob-lands. Its origin seems to be rather obscure, but it is probably a hybrid that has somehow migrated from the South-west of France.

Much of Professor Oliver's work has been done on Blakeney Point in Norfolk, an area that has now been taken over as a Nature Reserve by the National Trust. This receives much detailed description, with abundant illustrations, and the section is perhaps the most interesting in the whole book. The volume finishes with chapters on the obligations of the State in respect of coast protection, national waterways and harbours. Appendices are added containing a classification of plants in respect to situation, while one gives a list of Authorities charged with the duty of sea defence. The work appears most opportunely at a time when problems of reclamation are engaging public attention, and is sure to be widely read and studied.

W. SOMERVILLE.

Co-operation for Farmers, by Lionel Smith-Gordon. (Williams & Norgate, 1919. Pp. xiv. + 247. 6*s*. net.) In an Oxfordshire village there is the singular case of a man who has chosen a vocation appropriate to his name. He is a blacksmith, and his name is Puffett. But he might have done even better. What name, for instance, could be more appropriate to the calling of a publisher's advertising agent? Here is a book which, so the wrapper states, "gives those considering the foundation of Co-operative Societies the information they require." This is a great claim, and we could wish that it had been substantiated. It is true that the author deals with the legal constitution and organisation of co-operative societies in his Introduction, but the main part of the book deals with the historical, economic and social aspects of agricultural co-operation in Ireland, Western Europe and the

United States of America. Such a comparative study may be of great assistance to those who have to think of the future of the rural co-operative movement—the leaders of the general movement itself, statesmen, and the ordinary citizen who is interested in social developments. Clearly, however, the attention of founders of co-operative societies have to fix their minds upon more prosaic details.

Mr. Smith-Gordon, who is assistant secretary of the I.A.O.S., and Librarian of the Co-operative Reference Library, Dublin, is interested in the philosophy of the co-operative movement. Consequently he begins his disquisition by a study of definition and ideals. He might have remembered a remark once made by Henry Sidgwick, the economist, that the final discovery of the perfect definition, should that ever be possible, was less essential than the preceding search. In this case we are told quite clearly what co-operation is not, and left practically free to imagine what it is. This is quite a happy result, for after all the co-operative movement is the result of many varied human activities, and what it is going to be depends very largely upon the work of our imaginations as modified by experience. And Mr. Smith-Gordon is certainly bold when he starts addressing English agriculturists by dealing with ideals. He has not, however, more boldness than his task makes necessary : in other words, he is not foolhardy. The world is moved by ideals, conscious and unconscious, or rather, expressed and unexpressed. The agricultural co-operative movement is the expression of the most common social ideal held by farmers in the western hemisphere. This being so, it might be urged that the English farmers have been diffident in their relations with the movement, their ideals have little potency. This is not necessarily true ; but it is nevertheless true that such ideals as they have do not bring them in close touch with the movements which are determining the future economic organisation of society. The essence of the ideal of the co-operative commonwealth is that it provides for the attachment of due importance to the twin principles of individualism and association, even of individual property and mutual effort. As Mr. Smith-Gordon expresses it, co-operation "implies no interference with individual freedom or effort, no attempt at conscious levelling of distinction, but merely an effort to ensure by practical economic steps that self-help shall be accompanied by mutual help." Here, surely, is an ideal which farmers would be wise to study before they are in danger of disappearance before the expression of ideals held by other classes of people with which they would have much less sympathy, and which would arouse their active distrust rather than confidence.

On the psychology of the movement Mr. Smith-Gordon has made many interesting and illuminating researches. Pages 49 to 54 provide a very much needed analysis of some of the difficulties connected with human nature which the ardent co-operator has to face. And he, wisely, states a fact overlooked by many idealists,—"it is very seldom that a co-operative movement has taken successful root in any county except as a result of absolute necessity." This necessity has sometimes been expressed as the alternative, "co-operation or starvation"; but the absolute necessity of the future in England, as previously hinted, is more likely to be some ideal (or spiritual) necessity rather than mere material poverty. If this is true, one statement of Mr. Smith-Gordon's may be of profound importance. He says: "Co-operation requires a certain type of human material both for leaders and for followers, and this type must be built up, usually out of adversity, by patient training. It is material most usually found in the humbler ranks of life, sometimes in the aristocracy who have been trained for service, but seldom at present among the higher *bourgeoisie*."

We cannot follow Mr. Smith-Gordon through the many details of the history and organisation of agricultural co-operation in Ireland, Denmark, Germany, and U.S.A., but we have said sufficient to indicate the importance of the subject, and this contribution to our knowledge of it, to those whose mental capacities are not wholly absorbed by the details of the present organisation for the production and exchange of agricultural produce. Chapters on the relations of the State to the co-operative movement, and on the future of the movement itself, will be particularly interesting to those who have taken some part in agricultural co-operation, and have been forced to think on the broader problems confronting the movement. For those who wish for further guidance in the study of the subject a very useful bibliography is provided.

The book is interesting, in spite of the fact that it is not exactly what the publishers say it is. If the publishers, not yet being co-operators, do not accept the principle laid down by the author for co-operative societies that "ordinary trade practices must be eschewed," they might, at least, have adopted another co-operative principle, and used a more suitable paper for a book of this character and price.

A. W. A.

Practical Cheesemaking: a general guide to the manufacturer of cheese, by C. W. Walker-Tisdale and Walter E. Woodnutt. (Published by Headley Bros., Kingsway House, Kingsway, W.C. 2, 182 pp., 4*s*. 6*d*. net). **Dairy Farming**, by C. H. Eckles, D.Sc., Professor of Dairy Husbandry, University of Missouri,

and G. F. Warren, Ph.D., Professor of Farm Management, New York State College of Agriculture, Cornell University. (Published by The Macmillan Company, New York, 309 pp., 5*s.* net).

The authors of *Practical Cheesemaking* are to be congratulated that they have not withheld publication of their book until after the war as was their original intention. During the last three years this country has required the assistance of all its experts in food production, and, in view of the need for an increased output of cheese, it would have been most regrettable had the valuable information contained in this book not been at the disposal of cheesemakers.

The book consists of some twenty-four chapters, and deals in a lucid manner with almost all aspects of cheesemaking. The early chapters deal with the location and construction of dairies, and with the composition and management of milk for cheesemaking. A plan of a dairy showing the most convenient arrangement of the different rooms and the position of the internal fixtures would have added to the value of the first chapter, and there might well be some difference of opinion on the question of a verandah round a dairy. Whatever good effects a verandah may have in lowering the temperature in summer is more than counterbalanced by the lessened admission of daylight. Ample light is a great aid towards cleanliness, and sunblinds may well replace verandahs on modern dairies. In the third chapter, which deals with bacteria and other ferments in milk, the difficult subject of enzymes is discussed in a confident manner which is scarcely in keeping with the paucity of accurate knowledge; a recognition that there is room for much investigation in this subject would not have lessened the value of the book. The final statement in this chapter: "When milk is obtained from healthy cows, and under the best conditions, it will contain the right kinds of organised ferments and enzymes which are required for the manufacture of cheese," is somewhat at variance with the following sentence on page 31: "The species of bacteria essential for the production of good cheese can be added to the milk in the form of a starter."

The quality of milk for cheesemaking is fully dealt with, but on page 38 it is surprising to find the statement, that "during the first two periods of lactation a cow yields poorer milk than subsequently." There is now ample evidence to prove that the quality of a cow's milk is highest in the first lactation period, and that in the succeeding periods the quality decreases.

Chapters VI. to X. are devoted to explanations of the simpler methods of milk analysis, tests for the purity of milk such as

may be employed either on farms or in factories to determine the source of tainted milk and a description of the means adopted to ascertain the amount of acidity in milk and whey, and the nature and action of rennet. These chapters, together with that on the preparation of "starters," contain much information of great value to the cheesemaker. The appliances for the complete equipment of a cheesemaking dairy are fully dealt with, and useful suggestions given as to the care of the plant during the non-cheesemaking season.

In the second half of the book the process and methods of cheesemaking are dealt with in detail. It is no easy matter to describe cheesemaking in such a fashion as to convey to the reader a correct idea of the various processes and of the numerous variations which may be adopted in order to modify or correct the effect of some defect in the milk, or of some error at an earlier stage. Nevertheless, the authors, by dealing in the first instance with the different stages, irrespective of individual varieties, and subsequently by a concise summary of the chief points in the manufacture of Cheddar, Cheshire, Leicester, Derby, Caerphilly and Wensleydale cheeses, have accomplished their task most successfully. With such a foundation laid it is unfortunate that some additional chapters were not added to deal with Stilton cheese, with some of the commoner types of soft cheese, and with the utilisation of sour milk, in the form of curd or cottage cheese.

An appendix of data for students is most useful, and the method of giving paragraphs on specific subjects, consecutive numbers corresponding to those in the index, adds to value of the book for reference purposes.

To those who are familiar with the work of contemporary American agricultural investigators and writers, the names of C. H. Eckles and G. F. Warren are well-known, and a warm welcome will be assured beforehand to any book which bears their names.

In this instance they are the joint authors of a book on Dairy Farming, which is the first of a Farm Series, designed to give the basic principles of different branches of agriculture without being superficial.

Professor Eckles contributes seven chapters dealing with dairy live stock, their improvement and management, housing and ailments, and with milk and its utilisation. Professor Warren writes six chapters on the dairy industry and the conditions affecting its development, systems of farming, methods of marketing and other factors affecting the success or failure of dairy farming as a business.

English readers are often apt to pay little attention to American books on farming, because of the differences as to

climate, nature of soil, conditions of tenure, density of population, &c., which obtain in the two countries, but this attitude may easily lead to a disregard of books which are most stimulating to the imagination and full of ideas, which if adapted to home conditions, would lead to material improvement in many branches of farming.

In respect of the section of this book dealing with dairy live stock even the national differences mentioned above scarcely apply, as the breeds of stock dealt with are common in this country—Holstein-Friesian, Ayrshire, Jersey, Guernsey, Shorthorn, &c.—and the methods of selection, improvement, management and feeding which are applicable in the one case, generally apply in the other. There is almost a national demand for an increased output of milk in Britain at the present time, and, with the steady increase in milk recording and the consequent effort to improve the herd, it may be of considerable advantage to the English dairy farmer to study the methods of selection of cows and bulls, and the methods of feeding advocated by one of the most reliable authorities in the United States. That success has attended these methods is evidenced by the table on page 66, which gives the records of twenty-six cows (eighteen Holstein, four Jersey, three Guernsey and one Ayrshire) which have produced over 950 lb. butterfat within twelve months, with yields of milk in the same period ranging from 16,457 lb. to 30,451 lb. An even more significant table is that given on page 72, in which the influence of eight bulls, as breeders for milk production, is indicated by a comparison of the records of the daughters and the dams. The daughters of one bull averaged 3,230 lb. milk per annum more than their dams, while in another instance the dams' average was 1,462 lb. per annum more than that of their daughters.

The chapters on dairy farm management by Professor Warren are not of the same direct value to English readers because they deal primarily with the bearing of the local circumstances which obtain in the United States on the financial returns from the farm. The final chapter, however, which discusses the most important factors in successful dairy farming deals with many points which should receive more attention from farmers in this country. In addition to emphasising the relation to profits of the size of the business, the returns per cow, the crop yields and the variety or specialisation of the business, the statement is made and supported by figures, that, other things being equal, large cows pay better than small ones.

From the point of view of the British critic, two features in this book are worthy of special mention. The first is that the writers are experts in two sections of farming—"Dairy

Husbandry" and "Farm Management"—hence each is able to deal in a masterly fashion with his own branch of the subject. In this country no university or college has yet seen fit to divide the encyclopædiac subject of agriculture into two or more sections. Some movement in this direction will surely be evident in the reconstruction of agricultural education and research in the near future. The second point is that the conclusions and advice of both the writers are, in almost every instance, based on the results of experimental work dealing with the points in question. In books and pamphlets on soils and manures, issued in this country, this desirable practice has been followed, but books on dairy farming have not as yet been based on such a reliable foundation.

For the agricultural teacher this book, in addition to the actual information it contains, has at the end of each chapter a list of questions and problems which, if modified to suit local conditions, should be of great assistance in obtaining better and more practical results from educational work. For this reason, in addition to the others previously mentioned, "Dairy Farming," by Eckles and Warren should be in the hands of every agricultural lecturer and teacher.

JAMES MACKINTOSH.

The Growing of Farm Seeds.—This short note is intended to direct the attention of farmers to the possibility of growing some of the more easily cultivated farm seeds, rather than as a treatise on the subject. Those interested should also read the article by A. W. Ashby on "Seed Growing in Essex" in Vol. 74 (1913) of the Society's *Journal.*

Little attention in the past has been given to vegetable seed growing in England, though the soil and climate are especially adapted for it, and where, with only a few exceptions, practically any variety of farm and vegetable seed can be grown. In 1914 this country was growing 3,000 acres of mangold seed, 3,000 acres of swede seed, 3,000 acres of common turnips, and, perhaps, nearly another 3,000 acres of various kale, radishes, vegetable seeds, sainfoin, clover, &c.

Previous to war the two great seed growing countries were France and Germany, and it would appear that a most favourable opportunity now presents itself for farmers in suitable districts to turn their attention to seed growing. Not only should there be a good market in England, but it is anticipated that there should be a large Colonial market as well.

The chief counties where seed is grown are South Lincoln, Cambridge, Bedfordshire, Worcester and Kent, though small amounts are grown in other counties.

In the following description of the growing of farm seeds, mangolds, swedes and common turnips are only dealt with. In the southern counties a rich loam is the most suitable soil for seed growing, and attempts to grow seed on land with chalk or gravel subsoil have ended in failure. As a general maxim, land that will grow cherries and apples will grow seed.

As a guiding principle, seed always requires new land, and this is especially so in the case of swede seed. From the writer's own experience over a period of forty years of seed growing in Kent, swede seed should never be grown more than once in seven years on the same land. Practically any rotation may be followed, provided that the land be kept clean, though rape and sprouting broccoli should never be grown, as the seed of these plants keep sound in the ground for years and may spoil a sample. For the year immediately preceding the seed, a bare fallow is the best preparation, as then a thorough cleaning of the land is ensured. Potatoes, however, are frequently grown as the preparing crop, and provided that the land be kept clean and well dunged, no evil results are experienced.

In preparing the land for the seed, the writer has always found it best to plough the land out in rows two feet apart for the seed bed plant. By so doing, a sufficient width is given for horse hoeing.

In Kent it is usual to sow mangold and swede seed in August ; the young plants are transplanted, in the case of swede, in December or January, although it is possible to transplant as late as February ; in the case of mangold, March or even April is the customary time.

In Lincolnshire the usual practice is to transplant in the autumn, for by so doing the seed is ready for harvesting at an earlier date, and this, in the case of mangold, is a great advantage. Common turnip seed is invariably drilled in September and not transplanted. As a general rule, 8 lb. of mangold seed, 4 lb. of swede seed and 4 lb. of common turnip seed are the amounts sown.

When transplanted, the plants should be put in 24 in. by 12 in. apart, in the case of swedes, and 24 in. by 18 in. in the case of mangolds. Provided the land has been thoroughly "well done" with farmyard manure to the preceding crops a dressing of 3 cwt. of superphosphate and 1 cwt. of sulphate of ammonia, applied in early spring, is usually found sufficient.

The inter-cultivation of the crop consists in horse and hand hoeing, to keep down the weeds, and in the case of mangolds, the writer has always found it necessary to top the plant when 18 in. high.

Mangolds sown in August and transplanted in March are ready to harvest in September. Swedes sown in August and

transplanted in December or January are ready in July or August, and common turnips drilled in September are ready in July. The correct time to cut is when the seed in the pod is turning a brown colour, but it is far better to lose a little seed than to spoil the sample by cutting too soon.

After cutting, the crop should be tied in small bundles, and when perfectly dry, stacked in narrow stacks. Mangold seed cannot be kept in the stack for any long period, as great loss will be suffered from vermin. Swede, on the other hand, may be kept in the stack for a much longer time, and as a general rule, sound seed, if kept in the straw, will keep its germination for a year.

Over a period of forty years the writer has found that the average yield for mangolds has been 10 cwt., and for swedes 16 bushels.

The chief pests that attack these plants are the Black Dolphin (aphis) in the case of mangolds, and a black beetle in the case of swedes and turnips. Severe frost without snow frequently kills the mangold plant. It is for these reasons that the price of mangold seed fluctuates so enormously. In 1889 the writer grew seventy acres of mangold seed, and in the early stages a crop of one ton per acre was expected, but in consequence of the blight, only two tons off the whole seventy acres were harvested. Next to mangold the greatest fluctuations are experienced in the price of swede seed. Here again a hard frost may kill off the plant, or the black beetle comes in the bloom some seasons, or canker in the root, which is ruinous to the crop.

The growing of seed requires the greatest care and attention, from sowing to delivery, carelessness when threshing or cleaning the seed may ruin the sample. The best stock can easily be spoilt by being grown near cabbages, for once the seed gets mixed it is quite impossible to separate it or even discover the trouble till the seed is grown.

Again, it must be remembered that a large amount of labour is required. Though it is a risky crop, yet taking an average year on suitable land, it is a profitable crop to grow.

W. Miskin.

REPORT OF THE COUNCIL TO THE ANNUAL GENERAL MEETING OF GOVERNORS AND MEMBERS OF THE SOCIETY,

HELD AT 16 BEDFORD SQUARE, LONDON, W.C. 1,
On WEDNESDAY, December 11, 1918, *at* 12 *noon.*

Membership.

The Council have to report that the list of Governors and Members has undergone the following changes during the year which has elapsed since the Annual General Meeting on December 5th, 1917; 38 new Governors (including 2 transferred from the list of Members under By-law 7), and 568 new Members have joined the Society; whilst the deaths of 9 Governors, 62 Life Members, and 154 Members have been reported. A total of 7 Members have been struck off the books under By-law 12, owing to absence of addresses; 144 Members under By-law 13, for arrears of subscription; and 1 Governor and 136 Annual Members have resigned.

Deaths of Governors and Members.

The losses by death sustained by the Society during the year include two Vice-Presidents, The Duke of Northumberland, K.G., and Mr. J. Marshall Dugdale. Mr. Dugdale, who died on October 31st, 1918, became a Member of the Society in 1888, was elected a Member of Council in 1891 and a Vice-President in 1906. He had acted as Steward of Dairying from 1899 to 1905, and had been Chairman of the Dairy and Produce Committee and of the National Agricultural Education Board, in the work of which he had always taken the liveliest interest. Amongst the other Governors and Members whose loss the Society has to deplore are the Marquis of Downshire, Earl Brassey, the Earl of Lichfield, the Earl of Portsmouth, the Earl of Rosse, Viscount Falmouth, Viscount Rhondda, Lord Cottesloe, Lord Forester, Lord Wenlock, Sir R. B. Boulton, Bart., Sir W. H. Houldsworth, Bart., Sir Powlett Milbank, Bart., Major Sir Edward J. Parry-Pryce, Bart., Sir R. H. Pollen, Bart., Sir C. Hubert Parry, Mr. W. L. Agnew, Mr. Frederick Ames, Mr. John Bamford, Mr. John Beaulah, Mr. M. Birtwistle, Mr. Albert Brassey, Colonel J. H. Burstall, Professor Thomas Carroll, Lt.-Col. the Hon. G. W. Clive, Mr. Edmund Cook, Mr. John Cookson, Mr. R. C. Cooper, Mr. J. Coulthard, Major F. N. J. Darbyshire, Mr. Alfred de Rothschild, Mr. J. Drewitt, Mr. Arthur W. F. Eade, Mr. J. Talbot Fair, Mr. N. W. Fairles-Humphreys, Mr. John Tudor Frere, Mr. R. Gordon, Mr. George Hankins, Mr. A. O. Haslewood, Colonel J. Hills, C.B., Mr. George H. Innes, Mr. J. J. L. Irving, Mr. W. T. Jordan, Mr. John Leigh, Mr. H. Le Strange, Mr. F. L. Lightfoot, Mr. J. W. Lovibond, Mr. M. W. Markham, Mr. W. C. May, Mr. G. B. Medcalf, Mr. James C. Merryweather, Col. A. Mesham, Col. C. N. Miles, Mr. Henry Moore, Mr. John Morton, Col. G. Mousley, Mr. E. C. Newcome, Mr. John Parr, Mr. John Pears, Mr. John Powell, Mr. M. K. M. Power, Mr. B. C. Ransome, Mr. W. J. P. Reading, Col. E. R. S. Richardson,

Mr. W. S. Richardson, Mr. W. H. Roberts, Mr. John Rogerson, Mr. H. V. Sheringham, Mr. Wm. Southall, Mr. T. F. Speakman, Mr. H. C. Stephens, Dr. Clement Stephenson, Mr. F. C. Strickland-Constable, Mr. Robert Tait, Jun., Miss Talbot, Mr. A. J. Taylor, Mr. S. Thirkell, Mr. J. R. Thornton, Mr. Percy M. Thornton, Mr. Charles Turner, Mr. W. P. Viccars, Mr. Thomas Wardle, Mr A. O. Worthington, Mr. J. D. Wragg, Major Wynne.

The deaths of the following Members of the Society have occurred whilst on active service:—Mr. R. G. Anderson, Mr. Francis M. Butler, Colonel Percy A. Clive, M.P., Captain E. B. Egerton, Major A. E. B. Fair, Captain G. FitzHugh, Mr. Charles H. Haslam, Mr. R. W. Mitchell, Major Geoffrey Neame, Mr. W. E. M. Stuart, Mr. Hugh C. Tower, Lieut. D. M. Watson, Captain M. D. Wood.

Number of Governors and Members on Register.

The above, and other changes, bring the total number of Governors and Members now on the Register to 10,954, divided as follows:—

224	Annual Governors;
101	Life Governors;
8,211	Annual Members;
2,393	Life Members;
25	Honorary Members;

10,954. Total number of Governors and Members as against a total of 10,861 Members on the Register at the time of the last Annual Report. This shows an addition of 25 new Governors and 68 Members elected during the year, and undoubted proof of the satisfaction felt among agriculturists of the work the Society has done during the past year.

Annual Election of Council.

Under the scheme of rotation settled in 1906, the Members of Council who retire at the Annual Meeting in December next, are those representing the following electoral districts comprising Group "C":—Cumberland, Westmorland, Yorks (East Riding), North Wales, Lincoln, Huntingdon, Cambridge, Oxford, Kent, Warwick, Gloucester, Glamorgan, Somerset, Berkshire, Sussex, and Ireland. The Members of the Society resident in those districts have all been communicated with, and the necessary measures are being taken for the election or re-election of representatives for the divisions concerned. In consequence of the increase of the membership in Sussex, this county will have its representation increased to two Members on the Council.

Accounts.

In accordance with the By-laws, the balance-sheet has to be presented for consideration at the Annual General Meeting. The Council therefore beg to submit the balance-sheet for the year 1917, with the Statement of Ordinary Income and Expenditure. These accounts were published in Volume 78 of the Journal issued to Members this year, having been duly examined and certified as correct by the Auditors appointed by the Members, and by the professional Accountants employed by the Society.

Agricultural Relief of Allies.

During the past year the Agricultural Relief of Allies Committee have given further help to the farmers in the devastated areas of our Allies, as military contingencies permitted. The relief given includes about 9,000 fruit trees which were distributed with a view to repairing the damage done by the enemy in the orchards of Northern France. The trees proved most acceptable and helpful.

Since the improvement in the military position in France the Committee have sent a consignment of Kerry cattle for distribution in the regions recently liberated. The Cattle were obtained in Ireland by the Royal Dublin Society by means of funds collected by that Society and were specially selected for their ability to thrive in their new home.

The Committee are now actively completing their organisation in order that they may be in a position to step in with help on a larger scale when the invaded countries are freed from the enemy. They ask for the generous support of members to enable them adequately to carry on the task they have undertaken.

Judges for Palermo Show.

At the request of the Sociedad Rural Argentina, the Council appointed the following Judges to act at the Palermo Show in September last:—

SHORTHORNS :

John Handley, Green Head, Milnthorpe.
A. W. Hickling, Wing Old Hall, Oakham.
F. H. Jennings, Gedding Rectory, Bury St. Edmunds.
(Mr. Jennings also judged the Down Sheep.)

HEREFORDS :

George H. Green, Church House, Ashford Bowdler, Ludlow.

These gentlemen have carried out their duties, and have returned to this country.

War Emergency Committee.

The War Emergency Committee, which was specially appointed to watch the effect of Departmental orders on the Industry of Agriculture, and where necessary to draw the attention of the Authorities to any orders which, in the opinion of the Council of the Royal Agricultural Society, might adversely affect the production of food, has met frequently during the past 12 months, and actively continued the work commenced in 1916.

On many questions the various Government Departments connected with Agriculture have asked for the views of the Committee, which have been readily given. Their representatives on Official Advisory Committees, and more particularly on the Central Advisory Council of the Ministry of Food, have been able to secure a clearer perception and a better appreciation of the difficulties which attend practical Agriculture.

The representatives of the Society on the Central Advisory Committee are the Hon. Cecil T. Parker (President) the Earl of Northbrook and Messrs. John Evens, Alfred Mansell and Henry Overman.

Beef Production.

Various questions connected with this matter have come before the Committee. The concession by the late Lord Rhondda of higher prices for cattle for the early months of 1918 somewhat improved the position, but almost simultaneously proposals for fixing the prices of store cattle were brought forward. The Committee were, however, instrumental in converting the Department to the impracticability of such proposals.

A protest against the change of selling cattle by live weight to sale by dead weight was made by the Committee, and after several conferences the option of sale by either system was allowed by the Ministry of Food.

The importance of obtaining an early announcement of prices was frequently urged by the Committee, and in particular an immediate declaration of prices for winter fed cattle and sheep for 1918-19 was asked for as early as April last. These prices were announced at the end of May, and although the increase was not large the confidence of the feeders and graziers was secured.

The Committee had the satisfaction of obtaining an assurance from the Department that the sale of Irish Cattle in this country should be under the same conditions as those regulating the sale of English Cattle.

The recent action of the authorities in turning back from the markets cattle fattened during the summer on the grass has been considered by the Committee, who, while regretting that the Ministry of Food had not fulfilled its undertaking to take over surplus cattle, pointed out the only possible means of alleviating the position—the taking of all cattle sent forward from the grass countries and the holding back of cattle in arable countries. As a further measure of assistance they suggested that in arable countries a liberal proportion of barley should be allowed to self-producers to feed such stock.

The Ministry have adopted these measures by closing cattle markets in arable countries, and by announcing the completion of arrangements to release to farmers 20 per cent. of each threshing of barley.

Sale of Offals.

The Ministry of Food, in response to a representation from the Committee, agreed to the freeing entirely of certain offals for cattle, sheep and pigs from the coupon system, and in other cases an increased weight per coupon.

Pig Breeding.

Attention has been drawn by the Committee to the economic value of pig breeding and the desirability of encouraging pig production, in the first place by increasing the live weight price, and in the second by affording better supplies of fattening food. In regard to the first point, the Ministry of Food increased the price from 18s. to 21s. per score live weight, and to 28s. per score dead weight (inclusive of offals). While the authorities are naturally determined to preserve as much grain as possible for human consumption, they promised to adopt measures safeguarding farmers both as regards the quality and price of

mixtures for pig feeding. Within the last few weeks the Ministry of Food have adopted a recommendation of the Committee, that in view of the scarcity of food for pigs Clause 9 of the Pig (Sales) Order, 1918, which prohibited the slaughter of pigs weighing less than 112 lbs. live weight, should be rescinded.

Feeding Stuffs.

The notice of the authorities has also been called to the anomalies relating to foods for stock and poultry, and the Committee have demanded safeguards against fraudulent adulteration and excessive charges in respect of mixtures which are often worthless or injurious.

Live Stock Export.

In conjunction with other bodies representative of live stock interests, the Committee protested strongly against proposals of the Government which would have seriously restricted the export of live stock. A resolution pointing out that such restrictions would be detrimental was followed by a deputation to the President of the Board of Agriculture, and the Committee had the satisfaction of securing the recognition of the views they advanced, and of helping the withdrawal of the restrictive measures.

Wool.

As a result of representations made by the Committee concerning the anomaly of the prices fixed for wool from sheep of the same breed, such prices varying according to the locality in which the flock was kept, the Army Council is now disposed to allow the quality of the wool, and the breeds from which it is obtained, to be the determining factors rather than the locality in which the wool is grown.

The Committee added their support to a resolution of the National Sheep Breeders' Association asking for an increase in the price of wool of 25 per cent. over the price ruling last year, but an increase of only 10 per cent. was eventually conceded. The Committee have recently urged that the price of home-grown wool for the coming season should be materially increased seeing that the cost of production has risen so greatly.

Milk.

In order to secure an adequate supply of milk for the winter of 1918-19 the Committee pointed out that it was essential, having regard to the substantial increase in wages, the shortage of concentrated feeding stuffs, the partial failure of the root crop, and the prospective shortage of hay, that there should be a considerable advance in the price of milk. The Ministry of Food have fixed the price of 2s. 3d. per gallon.

Hay.

Much anxiety having arisen as the result of the Army Council's restrictions imposed upon producers of and dealers in hay, the Committee sought, well in advance, to secure better treatment for producers in the matter of the 1918 crop. The proposals of

the authorities were ascertained, and the heads of the departments concerned courteously attended meetings of the Committee when these questions were under discussion. The Committee urged the importance of each farmer being permitted to reserve such hay produced by him as was necessary for his stock, instead of the suggested rationing at so much per head. The Committee were asked to nominate a representative on the new Forage Committee, and Mr. Henry Overman was appointed.

Since the harvest revealed the possibility of a shortage of hay, the Committee felt it advisable to publish an appeal to farmers and workmen to exercise the greatest economy in its use.

In regard to farm produce generally, the Committee have pointed out the necessity of reconsidering prices in the light of the increase in the cost of production through the advance of wages over and above the minimum wage fixed by the Corn Production Act. In respect of cereals the Committee pressed for higher prices than those for the 1917 crop, and protested against the fixing of a flat rate for barley of both milling and malting varieties.

General.

Other matters dealt with by the Committee have been the need for the provision of facilities for the delivery of potatoes by rail; the desirability of the removal of restrictions on the sale of butter made during May and June; the better employment of water and other small mills; the need for facilities for the provision of supplies of malt to furnish labourers with beer during the harvest; an appeal for official assistance in the destruction of rats, and the need for drafting Orders in plain and simple language and giving them the widest publicity.

As a national institution the Society can claim to have been helpful, through the Committee, in the adjustment of matters affecting the welfare of both producers and consumers, and to have done useful service to the country in encouraging the production of food.

Occasional Notes.

The publication of Occasional Notes, by the Scientific Officers of the Society, on matters of immediate importance, has been continued, and copies were issued to members in January, February, and July of this year.

Library.

The Catalogue of the Books in the Society's Library has been prepared and printed; copies will be ready early in 1919.

Chemical Department.

Notwithstanding the fact that the supply of fertilisers and feeding stuffs has been of such limited nature, there have been more samples submitted during the year by Members for analysis than in 1917, the figures for 1918 standing at 341 as against 307 in 1917. A considerable number of soils have been examined in view of the widespread conversion of pasture into arable land, and advice given thereon.

The number of samples of fertilisers submitted has naturally, in view of limited supply and controlled prices, fallen materially, but of feeding stuffs a considerable number have been sent, notably of compound meals. The materials used in these have frequently been of very inferior, and even doubtful, nature, and advantage has undoubtedly been taken of the relatively high "controlled prices" for "compound meals" to include in the composition waste articles possessing nothing like the presumed feeding value. Among these inferior meals have been many sold under the names of "pig meal" and "poultry mixture." Another plan resorted to has been to add to a staple material like, say, Palmnut meal (the controlled price of which is £13 5s. per ton) a small quantity of some other material, with the object of enabling the higher "controlled" price for "compound meals" (£17 5s. per ton) to be charged, though the real feeding value has been in no way increased and, indeed, often really reduced. Such instances have been noted from time to time in the "Occasional Notes" issued to Members of the Society. Three issues of these Notes have been made in 1918, and it is believed that they have served a very useful purpose.

Reference has also been made in "Occasional Notes" to the occurrence of wild mustard seed in rape cake, and to cases of injury to stock that have arisen thereby.

Woburn Experimental Farm.

In compliance with the request of the Board of Agriculture, the experimental area at Woburn has been reduced to the lowest limits possible, consistent with the maintaining of the experiments that form part of the continuous series long under investigation, and the remainder of the land has been devoted simply to the highest crop production.

The corn crops of 1918, and notably the Wheat, have been above the average. A good Hay crop also was obtained and Potatoes have been excellent. Swedes suffered much from the drought, but Mangels were quite good.

In response to the demand of the War Agricultural Committee, two pasture fields have been ploughed up and put into corn. In the one case, on heavy land, the ploughing was ordered to be done at a time when the land was not in fit condition; the work (by Government tractor) was badly done and the oat crop failed entirely. On the other field, of lighter character and then in suitable condition, the work (also by tractor) was properly done and an excellent crop of spring wheat was the result.

The calf-rearing experiments, which have given rise to so much interest, have been continued, and the attempt has been made to bring up calves—from the time of their purchase in the market when only a few days old—without any milk at all, either whole or separated. It has been shown in this experiment that by using linseed cake made into gruel with water it is possible to bring up calves without the use of milk. A movement is now on foot for extending the usefulness of some of the chief experiments carried out at Woburn, by getting Members in other parts of the country to repeat these under their own conditions.

The Annual Inspection of the Farm was made by the Council on July 31st.

Botanical Department.

There has been a marked diminution in the number of seed analyses required during the past year. This is probably due to the fact that seed merchants are required to guarantee the percentage of purity and the germinating capacity of the more important agricultural seeds. The number of enquiries concerning fungoid disease of plants was about the same as that of last year. None of the diseases reported on was particularly serious. The difficulty of keeping the land reasonably free from weeds under the present conditions has led to many more enquiries on this subject than usual. Questions regarding cereals, more especially the best varieties for different parts of the country, have also been unusually numerous.

Zoological Department.

The early part of the year was marked by the large number of complaints received of damage to corn crops on newly broken-up grass land by various ground pests, especially *Leather Jackets.* Very much corn was thus lost, and the desirability of first taking a crop of potatoes or roots on such land was greatly emphasised. Later there was a perfect plague of caterpillars. Winter moth, lackey, gold-tail and other species swarmed on fruit trees, and would, in ordinary years, have done much damage, but their effect was dwarfed by the non-setting of the fruit due to weather conditions. Other pests, such as bean-aphis, were very severe, but there were fewer of certain insects which did much damage in 1917, such as *Sitones* weevils on peas. Surface caterpillars were very injurious to roots, and in the Macclesfield district the grass moth did a great deal of harm. The only novelty of importance was a flea-beetle, *Phyllotreta vittula*, which occurred on barley. Though troublesome on the Continent, this pest has seldom been observed in England, but it this year caused the failure of certain barley crops. Forestry pests have given rise to fewer enquiries than usual, but probably only because time and labour to deal with them has been lacking.

Veterinary Department.

Since the beginning of the year there has been a marked decline in the number of confirmed outbreaks of anthrax—a fact which is probably attributable to the smaller consumption of imported feeding stuffs contaminated with the germs of the disease. The reported outbreaks of glanders have been fewer than in any previous year except the preceding one. There has been a decided reduction in the reported outbreaks of sheep scab as compared with 1917, but the disease has not yet been brought to the level of 1915 and 1916. The confirmed outbreaks of swine fever indicated a further decline in the prevalence of that disease. During the year there has been a great increase in the reported outbreaks of parasitic mange in horses. An outbreak of Foot-and-Mouth disease occurred in East Sussex during the last week of September, and during the following fortnight two other outbreaks occurred. All of these were on contiguous premises, and the total number of animals affected was 13. No case has occurred since the middle of October, and the country may again be considered free from the disease.

Rabies.

After sixteen years of complete freedom from Rabies, a case of the disease in a dog was reported from the County of Devon and confirmed in the first week of September, and since that date over 50 other cases have been reported from Devon and Cornwall.

Sheep Scab.

A deputation from the Council waited upon the Minister of Agriculture with regard to the outbreaks of sheep scab, and placed before Mr. Prothero information and suggestions with a view to checking the disease, which the President of the Board promised should receive careful consideration.

Parasitic Mange.

The striking increase in the number of outbreaks of parasitic mange in horses during the last two years has also engaged the attention of the Council. The principal causes of the increase appear to have been the reluctance of owners to give prompt notice of the existence, or suspected existence, of the disease, and the difficulty of securing efficient treatment under the existing conditions. With regard to the first of these, the attention of owners is called to the provisions of the Parasitic Mange Order, 1911, which requires every person having in his possession or under his charge a horse, ass, or mule affected with or suspected of parasitic mange, to give notice of the fact with all practicable speed to the police. Failure to give such notice renders a person liable to a fine of £20, and, in certain circumstances, to a month's imprisonment. The Mange (Amendment) Order, 1918, contains an important provision which, subject to certain conditions, allows affected animals to be worked while under treatment, and thus removes one of the grounds for neglecting to give immediate notice of the existence of the disease. Under that Order an owner may also employ his own veterinary surgeon to advise him regarding treatment. A series of leaflets which give valuable information regarding the symptoms and treatment of the disease has been issued on behalf of the Board of Agriculture and Fisheries, and may be obtained gratis on application to the Secretary, Joint Committee of the Board of Agriculture and Ministry of Food, 6a, Dean's Yard, Westminster, S.W. 1.

For the information of the members of the Society, the disease will be dealt with at length in the next Annual Report of the Principal of the Royal Veterinary College.

Diseases of Animals Act of 1896.

With regard to the resolution passed by the Council with reference to the Diseases of Animals Act, 1896, the following letter had been received from the Board of Agriculture and Fisheries:—

Board of Agricultural and Fisheries,
4, Whitehall Place, London, S.W.1.
November 20th, 1917.

Sir,—I am directed by the President of the Board of Agriculture and Fisheries to refer to your letter of the 9th inst.,

forwarding a copy of a resolution passed by the Council of the Royal Agricultural Society of England on the subject of the Diseases of Animals Act, 1896, and I am to acquaint you, for the information of your Society, that it is not the intention of His Majesty's Government to remove the present restrictions upon the importation of live cattle into the country.

In the case of cattle from Canada no legislation will be introduced unless and until the importation of live cattle born and reared in that country is found to be both practicable and consistent with domestic policy after the war, and in any case the Board would naturally, before any legislation is proposed, take steps to obtain the views of breed societies upon the subject and to impose whatever measures may be considered necessary to ensure that no appreciable risk of the introduction of disease should be incurred.

I am, SIR,
Your obedient servant,
(Signed) A. W. ANSTRUTHER,
Assistant Secretary.

The Secretary, Royal Agricultural Society of England.

Exportation of Pedigree Live Stock.

The Council at their meeting on June 5th appointed a Deputation to wait on the Minister of Agriculture with reference to the proposed restriction of the export of pedigree Live Stock, and as a result of the meeting with Mr. Prothero the following letter was received by Sir Gilbert Greenall, who had introduced the deputation to the President of the Board:—

SIR,—I am directed by the President of the Board of Agriculture and Fisheries to refer to the representations made to him by the members of the deputation which you introduced on the 5th inst., on the subject of the export of pedigree stock, and I am to say for your and their information that it has been decided to deal with applications for export on their merits without regard to average exports during the last three years or by an individual or to a particular country.

Exporters have been notified accordingly by the War Trade Department, and a notice of the alteration of procedure was inserted in the *Times* of the 12th inst.

Mr. Prothero thinks, however, that some members of the deputation may wish to be informed of this decision, and perhaps you will be good enough therefore to notify them accordingly either directly or through the Secretary of the Royal Agricultural Society of England.

I am, SIR,
Your obedient Servant,
(Signed) E. B. SHINE
(for Secretary).

Sir Gilbert Greenall, Bart, C.V.O.

Medals for Cattle Pathology.

As the result of the competitive examination at the Royal Veterinary College for the Society's Medals for proficiency in Cattle Pathology, including the diseases of Cattle, Sheep, and Pigs, the Silver Medal has been awarded to Mr. W. A

Williams, "Alandale," Abergavenny, and the Bronze Medal to Captain G. Barnett, M.C., Berwyn, Oakham.

"Queen Victoria Gifts."

The Trustees of the "Queen Victoria Gifts" Fund have made a grant of £140 for the year 1918 to the Royal Agricultural Benevolent Institution to be distributed as two gifts of £10 each in respect of male candidates, four gifts of £10 each in respect of married couples, and eight gifts of £10 each in respect of female candidates.

Women's Agricultural Committees.

Under the scheme of the Board of Agriculture and Fisheries for the appointment of Women's Agricultural Committees, the Council have nominated representatives to serve on the County Committees.

Dairy Research.

The Staff of the Research Institute in Dairying, University College, Reading, are prepared to undertake special researches in Dairy problems for members of the Society.

National Diploma in Agriculture.

The Nineteenth Annual Examination for the National Diploma in Agriculture was held at the Leeds University from the 20th to 24th April last, when 17 candidates presented themselves for examination, and five candidates were successful in obtaining the Diplomas. For list see page 223.

National Diploma in Dairying.

The Twenty-third Examination for the National Diploma in Dairying was held this year for English students from September 21st to 27th, at the University College and British Dairy Institute, Reading; and for the Scottish students from September 22nd to 28th, at the Dairy School for Scotland at Kilmarnock, twenty-nine candidates were examined at the English Centre, of whom 19 were successful, and at the Scottish Centre 22 candidates were examined, of whom 14 passed. The names of the Diploma winners will be found on page 226.

By order of the Council,

THOMAS McROW,
Secretary.

16, Bedford Square,
London, W.C. 1.

6th November, 1918.

NATIONAL AGRICULTURAL EXAMINATION BOARD.

I.—REPORT ON THE RESULTS OF THE NINETEENTH EXAMINATION FOR THE NATIONAL DIPLOMA IN AGRICULTURE,

Held at Leeds, April 20 to 24, 1918.

1. The Nineteenth Examination for the National Diploma in Agriculture was, by the courtesy of the authorities, held at the University of Leeds from the 20th to the 24th April last.

2. The subjects of Examination were Practical Agriculture (two papers), Farm and Estate Engineering (including (a) Surveying and Farm Buildings, (b) Machinery and Implements), Agricultural Chemistry, Agricultural Botany, Agricultural Book-keeping, Agricultural Zoology, and Veterinary Science. Under the Regulations, the whole eight papers may be taken at one time, or a group of any three or four in one year and the remaining group of four or five in the year following. Candidates taking the whole Examination in one year who fail in not more than two subjects are allowed to take those subjects alone in the succeeding year. Candidates failing in a single subject of a group are permitted to take that subject again in conjunction with the second group.

3. Seventeen candidates presented themselves, as compared with 25 last year. Two candidates took the whole Examination, 5 who had previously passed in certain subjects appeared for the second portion, one candidate was allowed to take the one subject in which he had failed last year, and the remaining candidates came up for a group of subjects.

4. The following are the names of the 5 Diploma winners in alphabetical order :—

Catherine E. Aitkenhead, West of Scotland Agricultural College, Glasgow.
Eileen Lambton, University College, Reading.
James G. Mitchell, Harper-Adams Agricultural College, Newport, Salop.
Leonard C. Robinson, Harper-Adams Agricultural College, Newport, Salop.
George L. Whyte, North of Scotland College of Agriculture, Aberdeen.

No candidate on this occasion reached the honours standard.

5. Of the 10 candidates appearing for a first group of subjects, the 9 whose names are given below succeeded in passing, and are therefore entitled to take the remaining subjects at a subsequent examination, when, if successful, they will be awarded the Diploma :—

DORIS ANDERSON, University College, Reading.
COWPER H. CHALMERS, Harris Institute, Preston.
FLORENCE DOROTHY HAWES, University College, Reading.
THOMAS HUNTER, JUNR., West of Scotland Agricultural College, Glasgow.
KENNETH S. MACLEAN, Harper-Adams Agricultural College, Newport, Salop.
MARY S. RIDOUT, Harper-Adams Agricultural College, Newport, Salop.
THOMAS SHARVIN, Royal College of Science, Dublin.
G. M. VELLA-CLARY, University College, Reading.
ARTHUR J. WAKEFIELD, Harper-Adams Agricultural College, Newport, Salop.

The tenth candidate failed in a single subject, which, under the regulations, he will be entitled to take again next year in conjunction with the second group.[1]

6. The Reports of the Examiners in the different subjects are appended :—

PRACTICAL AGRICULTURE. (First Paper 300 Marks. Second Paper 300 Marks.) Professor W. McCracken, J. T. McLaren, and Edward Porter, B.Sc.

The Examination of 1918 still finds the nations at war, and the comparatively small number of candidates who presented themselves, indicates to some extent the drain we are making upon the coming generation. The work of the candidates was not altogether satisfactory, and we regret to say that in no case did a student reach the Honours standard. Most of the students had a fairly wide acquaintance with agriculture, but we were unable to find one who had a real "grip" of the subject. We are not prepared to say that a higher standard of attainment should have been reached, considering the difficulties under which both the teachers and students have laboured, but we hope that the next examination will find us no longer at war and that the students will thereby have a better opportunity of becoming acquainted with the arts of husbandry.

FARM AND ESTATE ENGINEERING. (300 Marks.) (a) Surveying and Farm Buildings, Robert Cobb, (b) Machinery and Implements, T. Wibberley, N.D.A., N.D.D.

Surveying and Farm Buildings:—With the exception of three examinees, the answers to the practical questions in surveying and levelling were not well done; the laying out of survey lines and computing of areas, the very essence of agricultural surveying, being weak.

The knowledge of farm buildings was of a somewhat stereotyped nature, and the answers showed their origin rather from text books than from varied experience.

Generally speaking it seemed to me the training had been devoted to too many unimportant details and not sufficiently to the wider problems.

Although land drainage is part of the syllabus, the *viva voce* examination produced but a scant knowledge of this subject; to my mind this is becoming increasingly important and if I may respectfully make a suggestion, it would be that land drainage should have rather more prominence in the syllabus.

Machinery and Implements:—Of the eight candidates examined in this section, only two possessed any practical knowledge of the subject. It seems evident that neither the candidates, nor the teachers who prepared the candidates, have given any attention to the economic and practical aspect of farm implements. Such knowledge as candidates were possessed of was purely theoretical and it is lamentable to find Students capable of writing a long dissertation on the principles of working of the Otto-cycle, Semi-Deisel or Deisel engine, and be utterly incapable of stating how to alter the size of a sheaf made by a corn binder!

[1] To meet the cases of candidates who have passed a portion of the examination, and who, in consequence of their having joined His Majesty's Forces, may be unable to present themselves for the remaining subjects, the Board have agreed to grant to such candidates an extension of one year in which to complete the examination. The Board will also be pleased to consider applications for any further extensions of time that may be found necessary.

To give further examples, not a single student had ever heard of the simple attachment used on a binder for picking up lodged corn, and this attachment has been on the market for the last fifteen years. Again, only two students were able to describe a potato sorter, or give any idea as to the number of hands required for the economical working of same.

One student only was able to answer the question regarding an agricultural motor; the remaining students frankly admitted that such knowledge as they possessed had been gleaned from makers' catalogues. With the one exception referred to, not a student had ever actually handled a motor.

It is desirous to draw the attention of teachers and candidates to the fact that in future years the section on machinery and implements will be treated as a separate subject in which candidates must obtain pass marks.

It might also be mentioned that the motto of the R.A.S.E. is "*Practice* with Science," and that there is no feature of agricultural knowledge where practice as well as science is more desirable than in connection with agricultural machinery and the economical use of same.

AGRICULTURAL CHEMISTRY. (300 Marks.) Dr. Bernard Dyer, D.Sc., F.C.S., F.I.C., and Dr. J. Augustus Voelcker, M.A., B.Sc., Ph.D.

On the whole the candidates showed a better knowledge in matters of agricultural practice arising directly or indirectly out of the questions set them of agricultural chemistry as such. In several cases the candidates had evidently laboured under the disadvantage of an insufficient course of study in elementary general chemistry before beginning the special study of agricultural chemistry.

AGRICULTURAL BOTANY. (300 Marks.) Professor John Percival, M.A.

This year there were only eight candidates taking this subject.

Their work was uniformly good, and with one exception the candidates showed evidence of a more complete training than in previous examinations.

AGRICULTURAL BOOK-KEEPING. (200 Marks.) Alex. McCallum, M.A., LL.B.

The questions in book-keeping taken from actual farm accounts were comparatively simple and well within the capacity of candidates reasonably prepared. The papers returned were good and several were exceptionally well done. The answers to questions on general book-keeping practice showed on the whole a good grasp of principles, and in this respect an obvious improvement is to be noted as compared with previous examinations.

AGRICULTURAL ZOOLOGY. (200 Marks.) John Rennie, D.Sc.

Generally the knowledge of insect structure, parasites, and life-histories of field pests was found to be very good. Several candidates were found to have commendable first hand acquaintance with field conditions and tests. In other cases the knowledge regarding insecticides and treatment was too bookish. Laboratory books on the whole gave good evidence of sound practical instruction, and the number of drawings copied from text books is distinctly diminished.

VETERINARY SCIENCE. (200 Marks.) Professor Sir John McFadyean, M.B.

With very few exceptions the knowledge of the subject displayed by the candidates was quite satisfactory and above the average of recent years.

7. The thanks of the Board are again due to the authorities of the University of Leeds, for their liberality and courtesy in placing the Large Hall and other rooms of the University at the Board's disposal for the Examination; and to the Examiners, for the care and attention they bestowed upon the written answers to the papers set, and upon the *viva voce* examination.

CHARLES DOUGLAS, *Chairman.*
THOMAS McROW, *Secretary.*

16 Bedford Square, London, W.C. 1.
May, 1918.

II.—REPORT ON THE RESULTS OF THE TWENTY-THIRD EXAMINATION FOR THE NATIONAL DIPLOMA IN DAIRYING, 1918.

1. The Twenty-third Annual Examination for the National Diploma in the Science and Practice of Dairying took place in September, 1918. The Examination was held for English candidates at the University College and British Dairy Institute, Reading, from September 21 to 27; and for Scottish Candidates at the Dairy School for Scotland at Kilmarnock from September 27 and following days.

2. Twenty-nine candidates presented themselves at the English Centre, and of these the following nineteen satisfied the Examiners, and have, therefore, been awarded the National Diploma in the Science and Practice of Dairying:—

Amy M. Braithwaite, 31, Broad Street, Windermere.
Helen E. Burton, St. Andrew's Hall, Reading.
Kathleen M. Collens, St. Andrew's Hall, Reading.
Kathleen Crossland, St. Andrew's Hall, Reading.
Adelaide M. Davis, 52, Addington Road, Reading.
Olive F. Fawcett, St. Andrew's Hall, Reading.
Dorothy Hitchon, Rhyddington, Oswaldtwistle, Lancs.
Alice Lewis, Cark Hall, Cark-in-Cartmel, Carnforth.
Gwynaeth R. Lyne, University College, Reading.
Marjorie E. McCubbins, St. Andrew's Hall, Reading.
James McDonnell, British Dairy Institute, University College, Reading.
Olwen Matthews, 52, Addington Road, Reading.
Marjorie M. R. Muir, Nether Croft, Ayr, Scotland.
Barbara C. S. Prowse, St. Andrew's Hall, Reading.
Dorothy M. Salsbury, St. Andrew's Hall, Reading.
Frederick H. Spencer, Buenos Ayres, 44, Portchester-road, Bournemouth.
Rose Townend, St. Andrew's Hall, Reading.
Sophie C. Yorke, St. Andrew's Hall, Reading.
Catherine M. Williams, Bryn Awel, Gaerwen, Anglesey.

3. At the Scottish Centre, twenty-two candidates were examined, and of these the fourteen whose names and addresses are given below gained the Diploma:—

Margaret Carmichael, Torridon, Achnasheen, Ross.
Mary Cross, Alcaig, Conon Bridge.
Ethel M. Cruickshank, Sunnybank, Cruden Bay.
Jean Y. Cunningham, The Broom, Auchterarder.
Kate Edwards, Tydraw, Nelson, nr. Cardiff.
Isabel Helen Ellis, Kinclune, Glenkindie.
Annie A. B. Hutcheson, Balloan, Inverness.
David G. Ironside, Littlehill, Maud.
Jeanie MacGillivray, Easter Ellister, Port Charlotte, Islay.
Angusina Macpherson, Durine, Durness, Lairg.
Jeanie C. Mair, Waterside House, Fenwick.
Helen Penny, Shannas, Mintlaw.
Bessie Taylor, Ellangowan, Stevenston.
George Lee Whyte, Mains of Orton, Orton Station.

Mr. J. F. Blackshaw, who conducted at both centres the Examinations in General Dairying, in Practical Butter-making, and in capacity for impartng instruction, reports that "The answers given to the questions set in the paper in General Dairying at the English centre show, as compared with last year, a slightly better state of preparedness, but at the Scottish centre the standard remains at about the same level as in the two previous years.

"At both centres the average marks obtained were decidedly low, and the general trend of the answers given indicated that many of the candidates would have obtained a higher position had they been better able to express themselves.

"The questions set along the more usual lines were fairly well answered, but in the case of those of a less usual character (*i.e.*, outside the beaten track), requiring more thought, together with some display of reasoning power, were, in nearly all cases, unsatisfactorily dealt with.

"The results generally reaffirm the views expressed in my report last year that our training in higher dairying has not at present reached a stage of perfection.

"The practical work of butter-making was well performed, particularly at the Scottish centre.

"The arrangements for conducting the examination were as excellent as it was possible for them to be under the circumstances."

The Examiner in Cheese-making, Mr. John Benson, reports that "on the whole the work of the candidates at each centre was satisfactory, but not quite up to the standard of former years.

"A few of the candidates, at the Reading Examination, failed to pass the practical test, as, although they were intelligent and willing, it would appear that they had not received sufficient training, especially in the method of making Cheddar and Cheshire cheeses. The answers given in the written examination at Reading were, however, very good, and most of the candidates succeeded in passing the oral examination.

"At Kilmarnock the work of the candidates in practical cheese-making was of a high standard. During the many years that I have acted as examiner there, the work has not been surpassed. Some very fine cheeses were made, and only one candidate failed to pass the practical test. In the written examination, however, the work done by candidates was not equal to that of former years. A rather large proportion of the answers to the questions set were inaccurate, and especially those given to a question on keeping accounts at a cheese

factory. This is unfortunate, as it is most essential for the success of a cheese factory that the manager should have a thorough knowledge of account-keeping.

"The milk supplied this year at both centres was of excellent quality, and suitable for making fine cheeses. All arrangements for conducting the examinations were eminently satisfactory."

Dr. Voelcker, the Examiner in Chemistry and Bacteriology, reports that "the results, in my opinion, constitute a distinct general improvement on former years, so far as my experience goes. The number of failures was small, and though there, perhaps, was no outstanding feature of excellence, a better standard was attained generally.

"I was glad to find also some improvement in regard to the knowledge shown of elementary chemistry and its principles, though there is still need for paying attention to this side. A significant feature, as exemplifying the comparative disregard in which chemical discoveries made by British investigators are held, was the fact that out of eighteen candidates to whom the question was put, three only had ever heard of Argon as an element, while not even one of these three knew the names of Lord Rayleigh or Sir William Ramsay in that connection.

"The questions referring to the chemical side of dairying in particular were, on the other hand, well answered as a whole, alike in the paper work and in the *viva voce* examination. In the latter there was a marked improvement in the readiness and brightness of reply.

"Twenty-two candidates were examined at the Kilmarnock centre, and though the actual failures in this subject were comparatively few in number, it cannot be said that the examination showed a high general standard of excellence. In a few cases very good papers were sent in, but the *viva voce* examination did not, as a rule, prove correspondingly good. This was due in large measure to an imperfect acquaintance with the general principles of chemistry, simple questions, such as the nature of elements, oxidation, reduction, etc., being but imperfectly replied to. On the other hand, there was a better understanding of bacteriological principles in their application to dairy practice."

CHARLES M. DOUGLAS,
Chairman.

THOMAS McROW,
Secretary,
16, Bedford Square, London, W.C. 1.
October, 1918.

ANNUAL REPORT FOR 1918 OF THE PRINCIPAL OF THE ROYAL VETERINARY COLLEGE.

Anthrax.

The following Table shows the number of confirmed outbreaks of this disease in each year since 1911, when the present Anthrax Order came into force :—

Year		Outbreaks		Animals attacked
1911	...	907	...	1,120
1912	...	743	...	840
1913	...	594	...	652
1914	...	722	...	796
1915	...	575	...	642
1916	...	571	...	687
1917	...	421	...	480
1918	...	245	...	282

The striking fact in these figures is the great reduction in the number of outbreaks which has occurred since 1916, and especially during the past year. The highest number of outbreaks recorded since the disease was first scheduled (in 1887), was in 1910, in which 1,496 outbreaks were reported ; but the marked fall to 907 in the following year was not due to any decline in the frequency of the disease, but to the different method of diagnosis which was introduced by the new Anthrax Order. The figures for the year prior to 1911 denoted "reported" outbreaks, in which the diagnosis was made by the Inspectors to the different Local Authorities ; but in the succeeding years no suspected outbreak of anthrax figures in the official returns, unless the actual existence of the disease was "confirmed" by microscopic examination, supplemented, when necessary, by experimental inoculation, in the Laboratory of the Board of Agriculture and Fisheries. The more rigid method of diagnosis naturally led to the exclusion of cases reported in error, and this is the explanation of the apparent drop in the outbreaks for 1911.

During the eight years included in the Table the method of diagnosis has been uniform, and the figures may be accepted as corresponding with actual variations in the incidence of the disease during the period. In other words, there appears to be no reason to doubt that during the past year Anthrax in Great Britain reached its lowest ebb, with a total of 245 outbreaks.

As long ago as 1903, in the Annual Report for that year, the view was put forward that the provisions of the Anthrax Order were failing to reduce the number of outbreaks because they were exclusively directed against the *spread* of the disease within the country, and left untouched the *introduction* of the disease

from abroad by means of imported manure and feeding stuffs which were contaminated with the spores of anthrax. The facts in favour of this view were brought forward in subsequent annual reports, and fresh evidence has been provided by the events of the last two years. As is well known, the importation of feeding stuffs has declined since 1915, and it touched the lowest point during the past twelve months. This, and no other circumstance, can be held accountable for the coincident fall in the number of outbreaks of anthrax.

Assuming this view to be correct, it may confidently be predicted that the outbreaks will become more frequent in the following year, unless it is possible to devise some efficient means of preventing the contamination of those foreign materials which hitherto have often brought with them the germs of anthrax.

In conclusion, it may be pointed out that, even if all the outbreaks of anthrax in the country had this origin, the facts do not give occasion for alarm. In no year since 1911 has the number of cattle attacked with anthrax reached 1,000, which is an almost insignificant proportion of the animals consuming imported feeding stuffs : and the fact that the average number of animals attacked in an outbreak has always been less than two proves the efficiency of the present regulations for preventing the spread of the disease when its existence is promptly notified.

Glanders.

The following Table shows the number of outbreaks of this disease and the number of animals attacked in each of the last six years :—

Year		Outbreaks		Animals attacked
1913	...	162	...	447
1914	...	97	...	286
1915	...	50	...	87
1916	...	47	...	117
1917	...	24	...	62
1918	...	34	...	98

In spite of the slight increase in the number of outbreaks during the past year, the position with regard to glanders must be considered very good, especially when it is remembered that during the first six years of this century the annual outbreaks were always over 1,000. The figures given do not include outbreaks of glanders in army horses, among which a considerable number of cases have occurred since 1914. It is satisfactory that the existence of the disease in the Army has not led to any serious recrudescence of glanders among the general equine stock of the country, but there is a risk in that connection which might easily prove serious in the ensuing year, when, presumably, large numbers of army horses will be brought back from

the different fronts for sale to civilian purchasers. The risk will have to be met by regarding all such horses as suspected until they have been tested with mallein, and even then their new owners would be well advised to keep them isolated for a few weeks, and have them re-tested before concluding that they are safe to mix with other horses.

Among such animals loss of condition without recognisable cause, a discharge from the nose, enlargement of the glands under the jaws, marked swelling of the legs, or the formation of sores in connection with the skin of the body or limbs, ought immediately to be followed by notification of the case to the Local Authority.

Sheep Scab.

The following Table shows the number of reported outbreaks for the past six years :—

Year		Outbreaks
1913	...	236
1914	...	226
1915	...	257
1916	...	381
1917	...	543
1918	...	351

The fall in the number of outbreaks in 1918, as compared with the two previous years, is gratifying, but it is to be regretted that the actual eradication of the disease appears to be no nearer than it was five years ago. A large proportion of the outbreaks in England are traceable to the movement of sheep from Scotland and Wales, and probably the whole of these might be prevented by double dipping when the animals arrive at their new pastures.

The difficulty of eradicating sheep scab from the large hill farms in Scotland and Wales must be recognised, but it is far from insuperable, and the present time appears appropriate for the introduction of sharper measures in dealing with the disease, and especially with those who neglect its treatment, or deliberately conceal its existence in their flocks.

Swine Fever.

The following Table shows the number of confirmed outbreaks of this disease during the past five years :—

Year		Outbreaks
1914	...	4,356
1915	...	3,994
1916	...	4,331
1917	...	2,104
1918	...	1,407

Since September 1915 the previous policy of attempting to stamp out swine fever by slaughtering all diseased and suspected

pigs has been abandoned. The present method of dealing with the disease was described at length in the previous volume of the *Journal* (page 48), but it may be here recalled that when the existence of the disease on any premises has been established the owner is given the option of having the surviving apparently healthy pigs treated with serum or left untreated.

When serum treatment is accepted healthy pigs may by licence be moved off infected premises for immediate slaughter, and other pigs may be moved on for fattening purposes, the latter being usually treated with serum on arrival. The owner is thus able to continue his pig-feeding business although infection may be present on his premises.

Whether serum treatment is accepted or refused, the restrictions on the movement of pigs to and from the infected premises are maintained only if in the opinion of the Board the disease has ceased to exist there.

It is satisfactory that the reduction in the number of outbreaks which occurred in 1917 continued during the past year, but it is yet too soon to say whether this decline has been in any degree brought about by changes in the method of dealing with outbreaks, or whether it is not in great part the result of a marked reduction in the number of swine kept throughout the country.

It is understood that an increased proportion of owners accept the serum treatment, and that the results in outbreaks thus treated continue to compare favourably with those which follow in outbreaks in which serum is not used, and the disease is simply allowed to run its natural course except in so far as it is interfered with by voluntary slaughter of the marketable pigs on the premises. The comparison appears to be specially favourable to the serum treatment in outbreaks in which large numbers of breeding sows or young pigs are involved.

Foot-and-Mouth Disease.

During the year 1916 there was only one outbreak of foot-and-mouth disease in the United Kingdom. It occurred in the month of February, and the consequent restrictions were removed in the following month.

There were no outbreaks during 1917, and the country remained free from the disease until September, 1918, during which month it was detected on premises in East Sussex. Two other outbreaks were reported in the same neighbourhood during the following week, and the total number of animals attacked in the three outbreaks was 14.

Inquiry failed to indicate by what means the infection had been introduced into the country, but it is highly probable that it was brought by some human being or animal, or some

inanimate object, from France or Belgium, in which countries the disease is known to have existed during the past year.

Rabies.

The most regrettable event in connection with the diseases of animals during the past year was the introduction of rabies, from which Great Britain and Ireland had been entirely free for a period of sixteen years. The first confirmed case of the disease was reported from Devon in the first week of September, but facts which were afterwards brought to light indicated that unreported cases had occurred among dogs in Plymouth and the neighbourhood during the previous three or four months.

Owing to this lamentable failure to recognise the earliest cases, and an unaccountable delay in applying a wide muzzling order when the existence of the disease had been proved, the outbreak soon assumed a very menacing character, and by the end of the year 98 cases in dogs and six in other animals had been reported, while 21 persons were bitten by rabid dogs or cats. In spite of these facts there is no reason to doubt that the disease will soon be again exterminated, as there is valuable experience to show what are the measures necessary to that end.

The first Rabies Order was issued in 1886, and there are no reliable data from which to estimate the extent to which the disease existed among dogs in this country prior to that time. That it was very common, however, is indicated by the fact that during the twenty years 1867–1886 no fewer than 754 human beings were reported to have died from hydrophobia, or an average of 37·7 per annum.

From 1887 to 1896 the power to impose muzzling in districts in which the disease existed was vested in the Local Authorities, and how ineffectually this power was exercised may be inferred from the fact that, whereas the number of cases reported in the first year of the period was 217, it had risen to 438 in the last. During this period 139 deaths from hydrophobia in man were reported.

In April, 1897, a new Rabies Order transferred the power of imposing muzzling regulations to the Board of Agriculture, and the effect is shown in the following Table :—

Year		Counties affected		Cases
1896	...	41	...	438
1897	...	30	...	151
1898	...	10	...	17
1899	...	4	...	9
1900	...	2	...	6
1901	...	1	...	1
1902	...	4	...	13
1903	...	none	...	none

The number of reported deaths from hydrophobia was six in 1897, and it fell to two the following year. There were no cases during the three years 1899-01, but two were reported in 1902, in one of which cases the patient had been bitten while abroad, while in the other the disease was attributed to the man having been bitten by a strange dog two years previously. No cases of hydrophobia were reported in this country in the period 1903-17.

The almost immediate success of the measures adopted in 1897 were mainly due to the prompt enforcement of muzzling over a wide area wherever the existence of the disease had been established, and its continuance for at least six months after the discovery of the last cases. Complementary measures which had a share in the results were more accurate diagnosis and enforced quarantine of imported dogs.

It is fortunate that discoveries which have been made since 1902 have made it possible to arrive at a diagnosis in suspected cases of rabies much more quickly than was the case before. Formerly there were many cases in which a definite diagnosis could not be made except by experimental inoculation, and that entailed a delay of two or three weeks. At the present time the great majority of cases of rabies can be correctly diagnosed within twenty-four to forty-eight hours after death by detection of the so-called Negri bodies in the suspected animal's brain, and this has a great advantage in enabling the Board of Agriculture to impose muzzling where it is required with the least possible delay.

Until the country has again been freed from rabies it is of the utmost importance that the public, and especially dog-owners in and near districts where the existence of the disease has been established, should keep in mind what are the usual symptoms exhibited by rabid dogs, in order that the notification which the law requires may be given at the earliest possible moment. Briefly these are as follows :—

Usually in dogs closely observed the first symptom noticed is an alteration in the animal's aspect or demeanour. The change takes the form of an unusual excitability or restlessness, but this may alternate with an appearance of dulness and a desire to hide in dark corners or places. Even at this early stage the appetite for ordinary food is usually lost. The animal may bark or howl without any obvious cause, and the tone of the voice may be recognisably altered. At this stage the dog still exhibits the usual affection for his human friends, and will come when called, but his temper is already uncertain, and he is easily provoked.

It is very greatly to be regretted that the disease is seldom or never diagnosed, or even suspected, at this early stage except

in animals under suspicion in consequence of their having been bitten by a dog known to have been rabid. Animals presenting such symptoms should, if possible without actual handling, be secured by themselves in a room or other confined space, and notification should immediately be given to the police.

In what is called the "furious" form of rabies the disease very soon (within a day or two) passes into its second and more dangerous stage, in which the dog begins to show the most characteristic symptom. That is the propensity to bite. It may be first evinced by his snapping at, or actually biting, some person who is caressing or handling him, but the inclination is often not suspected till the dog makes an unprovoked attack on some person. If he is in company with or meets other dogs these are usually attacked with ferocity, and seemingly in preference to human beings.

If the dog is at large he now usually leaves his home and wanders more or less aimlessly, and if he reaches the open country he may travel many miles before he is killed or dies. During this wandering stage the mania for attack and fighting persists, and either human beings or animals of any sort that come in the dog's way are almost certain to be bitten.

Death in an exhausted and paralysed condition closes the scene in a few days—generally within a week from the onset of the first symptoms.

In what is termed the "dumb" form of the disease the indications of actual "madness" are much less pronounced, and the lower jaw at an early stage becomes more or less completely paralysed, in consequence of which the mouth remains open and saliva continues to trickle from it. In many cases of this kind the dog is thought to be "choked," and human beings have been infected through being bitten while searching for the supposed foreign body in the throat.

In conclusion it may be said that the outlook for human beings bitten by rabid dogs is now incomparably less dark than it was half a century ago, before Pasteur had introduced the method of preventive treatment which has proved to be so brilliantly successful when it is begun within a few days after the bite. The most recent statistics show that among the patients bitten by rabid dogs and promptly treated by this method less than 1 per cent. develop hydrophobia. Notwithstanding this fact, a heavy burden of guilt lies on the person who, by violating the regulations regarding the importation of dogs, reintroduced rabies into this country. Unfortunately in most cases the fines inflicted for the offence are quite inadequate to act as a deterrent.

Parasitic Mange in Horses.

Mange in horses has been a notifiable disease since the beginning of 1912, when the Parasitic Mange Order of 1911 came into force. The following table shows the number of cases and outbreaks reported in each year since then :—

Year		Outbreaks		Horses attacked
1912	...	2,873	...	6,068
1913	...	2,382	...	4,647
1914[1]	...	1,530	...	2,642
1915	...	933	...	1,995
1916	...	2,147	...	4,689
1917	...	2,614	...	4,873
1918	...	4,463	...	8,377

The equine diseases which are included under the term mange are similar in nature to human itch or scabies and to the different forms of scab in sheep, all being caused by



Fig. 1.—Female parasite of sarcoptic mange (× about 70).

minute animal parasites which live and multiply on the surface of the skin or in its substance. These parasites belong to the same order as the common cheese mite, which they resemble roughly in size and appearance, but they constitute a separate family, with three genera and a large number of species and varieties.

The horse is the natural host of three of these species, and each is responsible for a distinct form or type of mange.

The first and most serious of these is sarcoptic mange, which is caused by the Sarcoptes scabiei var. equi (see Fig. 1). It may affect the skin on any part of the body, but it does not

[1] The Parasitic Mange Order was suspended from August 6, 1914, to March 27, 1915.

usually involve the lower part of the limbs, and has no special preference for the mane and tail. It is the most serious form, because the parasites burrow into the cuticle or superficial layer of the skin and breed there. Their effects in the way of irritation are therefore more severe, and their protected position in the skin makes successful treatment much more difficult.

The second or psoroptic form of mange is caused by the Psoroptes communis var. equi (see Fig. 2). It is more amenable to treatment because the acari are surface parasites, but it is the most important because the commonest form of mange in this country. The earliest evidence of the disease is often seen



FIG. 2.—Female parasite of psoroptic mange (× about 70).

about the mane and tail, but it may spread widely over the skin of the body, head, and neck.

The third or symbiotic form is caused by the Chorioptes symbiotes var. equi (see Fig. 3), and its visible effects are usually confined to the skin of the legs from the fetlock downwards.

In all the different species of acari the two sexes are distinct. The fertilized females on or in the skin of affected animals lay a moderate number of eggs, which hatch out in from four to six days. The young acari or larvae which thus come into existence are distinguished not only by their small size, but also by the fact that they have only three pairs of legs, whereas the adult is provided with four pairs. After a few days the larvae undergo

a further development and acquire a fourth pair of legs. Thereafter they soon reach a stage of complete development and sexual maturity. Probably, as a rule, the shortest period within which what is termed the life cycle of the mange acari of the horse can be completed is about fifteen days.

The Parasitic Mange Order of 1911 deals only with the sarcoptic and psoroptic mange, and not with the symbiotic form of the disease. The Order makes it compulsory for every person having in his possession or under his charge a horse, ass, or mule affected with, or suspected of, parasitic mange, to give notice at

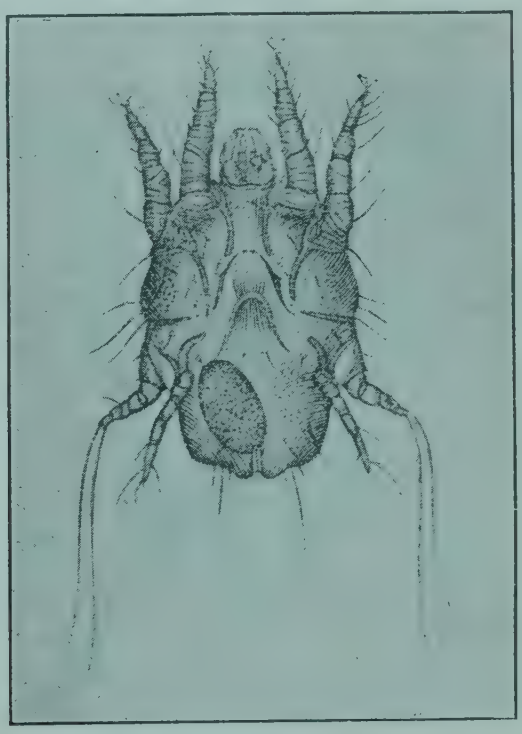


FIG. 3.—Female parasite of symbiotic mange (× about 70).

once to a constable of the police force for the area wherein the animal is, and also to keep the animal as far as practicable separate from other equine animals not affected.

It also makes it unlawful for any person to expose an affected animal in any market, fair, or sale yard, or in a market lair ; to send an affected animal by rail or vessel ; to take such an animal along a highway without the written authority of an Inspector ; or to place such an animal, or allow it to stray on common or unenclosed land, or a field or other place insufficiently fenced. Any contravention of the provisions of the Order renders the person or persons concerned liable on conviction to a fine of 20*l.*

The provisions of the Order of 1911 with regard to isolation have been somewhat relaxed by the Order of 1918, which permits of an infected animal being worked subject to certain conditions. It also allows an owner to employ his veterinary surgeon to advise him regarding treatment, which under the previous Order had to be prescribed by a veterinary inspector of the Local Authority.

From the point of view of an owner the most important provision of the Order is the one which requires him to give notice in any case in which there are reasonable grounds for suspecting that one of his animals is affected with mange, and in complying with this obligation an owner is not expected to distinguish between sarcoptic and psoroptic mange.

As it is incomparably easier to cure mange at its earlier than at its later stage, it is very desirable that owners should be well acquainted with the symptoms that ought to raise a suspicion of the disease. Obviously an early diagnosis is also of the first importance for preventing the spread of the disease.

In all forms of mange, just as in human scabies and in sheep scab, itchiness is as a rule the earliest and most striking symptom.

In consequence of this itchiness, the horse endeavours to nibble or gnaw the affected part if it is within range of his mouth, or, failing that, he endeavours to rub it against walls or other objects, or he may endeavour to scratch it with a hind foot. Rubbing of one hind leg with the other, and frequent stamping of the hind feet, are the invariable symptoms of symbiotic mange, which, however, as previously stated, is not a notifiable disease. When any affected part is brushed or scratched with the fingers or with a curry-comb, the horse will evince signs of gratification by turning his head towards the affected part and making nibbling movements with his lips. Irritant substances derived from the parasites and the actual movements of the parasites themselves are accountable for the itchiness, and later on the irritation becomes manifested by quite easily recognised alterations in the skin. The affected parts begin to lose the hair, and considerable areas of skin may soon be reduced to an almost bald condition, or show only a few stumpy or broken, bristle-like hairs. At other places the hairs may be more or less matted together with liquid which has exuded from the surface of the skin and then dried up. The more or less hairless skin may be either harsh and dry-looking, or it may show small pimples or coarse scabs. All of these alterations are partly the consequence of the irritation caused by the acari, and partly they are caused by the forcible scratching or rubbing of the parts by the horse in his efforts to allay the itching.

The Mange Orders of 1911 and 1918 not only impose restrictions on the movement of infected animals, but also insist that such animals shall be treated with some dressing or other remedy for parasitic mange approved for that purpose by a veterinary inspector of the Local Authority, or by a veterinary surgeon or practitioner employed by the owner of the animal to examine it. The first point in the treatment of any form of mange is to have a substance that is fatal to the acari without being seriously harmful to the horse, and the second is to secure actual contact between this material and the parasites. As previously stated, there is exceptional difficulty in securing such contact in sarcoptic mange. The psoroptic form of the disease can be cured as rapidly, and with as much certainty, as the corresponding disease in the sheep, namely, sheep scab. So far as is known, any of the dips which can be used successfully for the treatment of the latter disease will also cure psoroptic mange, but, owing to the risk of poisoning through licking or food contamination, it is not advisable to use any of the arsenical dips for the treatment of horses.

During the past year very successful results have apparently been obtained by treating outbreaks of mange, and especially the psoroptic form of the disease, with what is known as the "sulphur and lime" dip, applied to the whole of the horse's skin by means of a spray pump.

A series of valuable leaflets on the subject of parasitic mange has been issued by the Board of Agriculture, and may be obtained gratis on application to the Board. One of these describes the method of preparing the lime and sulphur dip and also the best methods of applying it. Here it need only be said that even in psoroptic mange at least two applications of the dip, with an interval of eight days, are necessary, and that any ordinary case of that kind can be promptly cured in this way. It is, unfortunately, equally certain that the sarcoptic form as a rule cannot be cured with two applications, and that in cases that have reached an advanced stage before treatment is begun actual cure can hardly be expected within less than a month or six weeks.

Abortion in Mares.

Further investigations regarding abortion in mares have confirmed the view that the microbe described in the previous Annual Report is responsible for the great majority of the outbreaks in this country, and that the disease in question can be diagnosed with great certainty by a blood test.

Members of the Society are invited to apply to the College for information regarding the best method of dealing with outbreaks.

Royal Veterinary College,
London, N.W.1.

John McFadyean.

ANNUAL REPORT FOR 1918 OF THE CONSULTING CHEMIST.

THE conditions recorded in last year's report have prevailed for the greater part of the present year, and the happy turn of events dating from the memorable day, November 11, has not had time as yet to show any effect in agricultural surroundings. Hence there is but little change to record, and another period of great difficulties for the farming community has been experienced. In no direction has this been more severe than in the matter of the supply of fertilisers and feeding stuffs, more especially the latter, for, while a few staple fertilisers like superphosphate, basic slag, and sulphate of ammonia could with more or less regularity be procured to a limited extent, imported feeding stuffs have been practically unobtainable, and dependence has had to be placed almost entirely upon home-grown produce and materials that under ordinary circumstances would hardly be regarded as "foods."

Under such circumstances it might well have been expected that the number of samples of the above submitted by members of the Society for analysis in the Society's Laboratory would undergo a further diminution. This, however, has hardly been the case, and inquiries on general subjects, and more especially on the treatment of soils where pasture land has been broken up for corn-growing, have been more numerous, the total number of samples submitted during the year being 341 as against 311 in 1917.

A marked feature, affecting fertilisers and feeding stuffs alike, has been the controlling of prices by the passing of various Orders. This has undoubtedly been to the advantage of the farmer in some respects, though, had it been done with more discretion, and made applicable to *all* classes of these commodities that are offered for sale, it would have been productive of more good, and have removed many of the anomalies that have prevailed, and which have left the door open to gross overcharges. The multiplicity of Orders issued, and the contradictory nature of these in some respects, have led to great confusion, and, in the end, while certain staple articles have been controlled as regards price and quality, a large number of almost worthless materials have been sold as food for stock, and without any control whatever. Nor has it been possible, in all but a few cases, to call in the operation of the Fertilisers and Feeding Stuffs Act, the Board of Agriculture having shown a marked reluctance to sanction any proceedings under this Act. The fact that 64 samples of compound feeding meals, &c., were sent to me in 1918 as against 18 in 1917, is evidence of the varied nature of the feeding materials met with,

and it is no exaggeration to say that over one half of these were sold at prices considerably beyond their value.

Thus, while the price of fertilisers was strictly controlled, and while compound manures, &c., had to be sold at unit prices fixed for their various fertilising ingredients, it was only certain staple articles of cattle food that were so dealt with, and with little or no regard to their composition. Consequently it was a simple matter to sell as food some inferior or waste material not included in the Schedule of any of the Orders issued, and to charge any price the vendor liked to put on it, and similarly to use such a material for compounding with others included in one of the Schedules, and to charge an arbitrary price for the mixture.

Numerous cases of this kind have been brought to my notice during the year, some of which will be referred to later.

As instances of some of the anomalies existing in the Orders the following may be mentioned :—Palm kernel cake, if "home manufactured," was controlled by the Cattle Feeding Stuffs (Maximum Prices) Order, 1918, at 13*l.* 15*s.* per ton, but if the cake was "imported" the controlled price was 15*l.* per ton. How was a farmer to know that he was not being charged the "imported" price for a "home manufactured" product? Again, while flour millers' offals generally were put at 13*l.* per ton, "Fine Barley Dust" was fixed at 17*l.* per ton, and "Coarse Barley Dust" at 8*l.* a ton only. One can imagine the divergence of opinion as to whether a sample was "fine" or "coarse," and yet a difference of 9*l.* a ton hung on it!

While the prices of wheat, barley, oats, and rye were regulated by the Grain (Prices) Order, 1918, and sundry mixtures were controlled by the Horse and Poultry Mixtures Order, 1917, many materials in common use, *e.g.*, maize, rice, beans, peas, &c., were not covered by any Order at all, and so a compounder had only to put one of them in his mixture and he could sell it at whatever price he liked.

Another device at one time common arose out of the fact that whilst the Cattle Feeding Stuffs (Maximum Prices) Order fixed the price of many cakes and meals composed of a single article, it allowed a price in many cases higher for compound cakes and meals. Palm-nut meal being fixed at 13*l.* 15*s.* a ton, and cotton seed cake meal at 14*l.* 10*s.* per ton, a compounder could make a meal of the two and claim the allowed price, for "compound meals," of 17*l.* 5*s.* per ton. Or, as was not unfrequently the case at one time, a meal composed for all practical purposes of one material only (palm-nut meal was a favourite one) was sold under a name such as "Feeding Meal," "Dairy Meal," "Pig Meal," &c., and the "compound meal"

price of 17*l.* 5*s.* was charged, whereas, had it been sold under its proper designation, a considerably lower price only would have been obtained.

The consequence of these and other well-intentioned efforts, but decided on by persons who had no thorough acquaintance with agricultural conditions, was to encourage the sale, at exhorbitant prices, of mixtures composed frequently of waste materials that had escaped being "controlled." The practical impossibility of getting linseed, cotton, and other feeding cakes, and the general dearth of feeding materials, afforded facilities for the putting on the market of a number of mixed meals of very doubtful character which were sold under fancy names such as "Calf Meal," "Pig Meal," "Poultry Mixture," "Horse Mixture," &c., at prices of 20*l.* to 25*l.* a ton or more.

In connection with feeding materials several instances were brought to my notice of the use of undesirable and even injurious materials. Such were the occurrence of castor oil bean in compound foods, of mustard seed in rape cake, and of salt in excessive amount in foods given to pigs and to poultry. Several cases of loss and injury to stock arising from these causes were recorded. As the Table at the end of this report indicates, linseed and cotton cakes were almost unprocurable; the position was slightly better as regards palm-nut and ground-nut cakes, but no others came to the fore, and what was available was generally diverted into the more profitable form of "compound cakes and meals."

The difficulties with regard to fertilisers were not so pronounced as with feeding stuffs, the Government recognising that it was useless to encourage farmers to grow more corn unless at the same time manure was provided for fertilising the soil. Accordingly, provisions were made to this end, and the general result was much more satisfactory than with feeding stuffs. A system of control of prices was likewise formed for these, and it had, very properly, some reference to the inherent fertilising constituents contained. Not that the system was by any means a perfect one, and in many cases injustice was done and anomalies were far from absent. But, as regards the three main articles—superphosphate and basic slag among phosphatic manures, and sulphate of ammonia among nitrogenous ones—the position was generally satisfactory. One good feature introduced was the practical abolition of the sale of basic slag according to "solubility in citric acid," and against which I have often written. The practice now came to be that of selling according to "total phosphate" contained.

While the exigencies of the time were met in the supply of these three fertilisers, I cannot regard the result as an

unmixed benefit so far as the land is concerned. To continually manure land with acid and forcing manures like superphosphate and sulphate of ammonia must, in some cases at least, tend to its impoverishment, and the well-known experience of the plots at the Woburn Experimental Farm on which sulphate of ammonia has been used continually for a number of years affords clear proof of the exhaustion that may follow where land is insufficiently supplied with lime. The same is recognised in the occurrence of "finger and toe" in root crops manured with superphosphate, where lime is similarly absent. Were it to be accepted as a canon of belief that all that the land requires is manuring with superphosphate or basic slag to supply the phosphates, and with sulphate of ammonia to supply nitrogen, agricultural chemistry would have laboured in vain, and the work of Rothamsted, Woburn and other experimental stations have been thrown away. It is clear to any one conversant with the subject that much more than this is needed, and that the wants of each soil and each crop have to be studied. So, while allowing that exceptional times call for exceptional measures, I cannot regard the Compound Fertilisers Order of 1917 as by any means satisfactory. The unit prices fixed by it for the various constituents of compound fertilisers were settled upon almost regardless of the materials employed, either as regards the particular purposes they served or as regards the prices at which they were obtainable. Thus, in the Order, one finds sulphate of ammonia and nitrate of soda classed along with bone, guano, blood, fish, meat, cake, shoddy, &c., all alike being put at the same value per unit of nitrogen, whereas one knows that in the trade these unit prices are widely divergent. No regard is paid as to whether a material be "lasting" or not, or whether it be exhausting in its action or such as will more permanently benefit the land.

The result of this will be, for a time at least, to oblige manufacturers to employ the cheapest materials they can obtain, and to put a stop to the use of bone and other more lasting materials for the manufacture of compound manures, and I cannot think that this will, in the end, be to the benefit of the land or of agriculture generally.

The compulsory order given in many cases to plough up grass land has turned attention more to the quality of the soil and to its capacity for bearing corn crops, and numerous have been the inquiries on these points. Also the good old practice of liming land has been to some extent restored, and this would no doubt be largely extended were it not for the heavy cost of lime and the difficulty in procuring it of good and reliable quality. Analyses made of soils have frequently

shown the need of liming, and I am convinced that one of the best things for the soil of the country as a whole would be the regular practice of liming or chalking it. If this were done one need have little fear of injurious effect from the continued use of superphosphate or sulphate of ammonia, and there is little doubt, too, that artificial fertilisers generally would be found more effective.

Of "war-time" fertilisers, nitre-cake superphosphate, referred to in last year's Report, has practically disappeared, but flue dust, as a source of potash, continues to be supplied, and steps are being taken to prepare from it the purified salts of potash. Meantime, expectations of a plentiful supply of potash salts in the near future have been raised by the surrender to France of the Alsace-Lorraine provinces, the former possessing rich potash mines which will remove the past dependence upon the Stassfurt mines of Prussia. An interesting paper on the subject of the Potash mines of Alsace was read in November at the Society of Chemical Industry, by M. Paul Kestner, President of the Société de Chemie Industrielle (see "Journal of Society of Chemical Industry," Vol. 37, No. 21, November 15, 1918). In this it was shown that these mines contain vast supplies of potash salts of even richer quality than the Stassfurt ones. Reference was also made to deposits in Spain (Catalonia), which it is expected to develop before long, so that there is every prospect that the supply of potash for agricultural purposes will soon be made secure.

Another year's working of the Fertilisers and Feeding Stuffs Act has brought out further defects in the drawing up of this very faulty Act, and it is hoped that a thorough amendment of it will soon be made. Partly owing to the limited supply of both fertilisers and feeding stuffs, and also to the unwillingness —already alluded to—of the Board of Agriculture to sanction prosecutions, the Act has been largely a "dead letter." The Royal Agricultural Society, however has, by the publication of "Occasional Notes"—three issues of which were made in 1918 —continued to inform its members of cases of adulteration and overcharge, and to issue timely warnings. These issues have also contained the valuable suggestions and representations made to Government by the War Emergency Committee of the Society.

The last general point to which reference may be made is the extension of the Woburn Experiments to other parts of the country. Certain selected experiments which have been conducted for a number of years at the Woburn Experimental Farm are now to be carried out elsewhere, under the Society's advice and superintendence, by members who have agreed to try them on their own land and under their own conditions.

These are (*a*) continuous corn growing, (*b*) liming, (*c*) calf rearing. In this way it is hoped to extend materially the usefulness of, and interest in, the Woburn Experiments.

I proceed, as usual, to deal in detail with the principal matters of interest which have arisen from the examination of samples submitted to me by members during the year.

A. Feeding Stuffs.

There is little to be said about the ordinary feeding cakes such as linseed, cotton, ground-nut, palm-nut, &c., beyond that the few samples sent have generally proved to be good. One sample of sesame cake was found to contain 1·47 per cent. of oxalate of lime, this being small in amount as compared with what is sometimes met with in this kind of cake. No instances have occurred in which castor oil bean has been found in any of the foregoing cakes.

1. *Rape Cake.*

A brisk revival in the sale of this cake occurred early in the year, but it was soon found that its use was attended with considerable risk, owing to the frequent occurrence of mustard seed along with the rape seed. Many cases of injury to stock were recorded, and the use of the cake for feeding purposes soon dropped off altogether. Rape cake containing mustard seed will, if pounded and stirred up in water, and kept in a warm place, soon develop a pungent odour of mustard, and when this is noticeable it may be taken that it is risky to give such cake to stock. The following cases were brought to my notice by members :—

(*a*) Lincolnshire—3 heifers died after feeding on rape cake which I found to contain a large amount of mustard seed.

(*b*) Warwickshire—6 bullocks were taken ill, and one had to be slaughtered. The cake contained much mustard.

(*c*) Lincolnshire—a herd of 38 cows, fed on rape cake, was seriously affected, and 5 of them died at once after feeding on the cake. A sixth cow died subsequently. The Veterinary Surgeon's report stated that 16 or 17 animals were lying about in the yard, showing acute symptoms of colic. Intense inflammation was noticed in the first stomachs of the animals that died. I found the cake to be very pungent and to have much mustard in it. After somewhat prolonged negotiation the vendors allowed the owner a sum of 250*l.* to cover his losses.

(*d*) Lincolnshire—A member, in sending me two samples of rape cake, stated that his cattle would not eat either cake. They showed a wise discretion, for both samples contained mustard seed.

2. *Rice Meal and Rice Products.*

Rice meal, as has often been pointed out by me, is properly the rice bran or skin of the grain, but is a very different thing to the rough, indigestible, husks or "shudes" enclosing the grain. The latter, however, are often sold in place of the meal, or are used, ground up fine, for adulterating it and feeding meals generally.

(*a*) In one instance a material which proved to be nothing but the finely ground "shudes" was invoiced to the purchaser as "Italian Rice Bran at 10*l.* 12*s.* 6*d.* per ton carriage paid." The vendors were merchants on the London Corn Exchange. A sample of this gave, on analysis, 28·76 per cent. of woody fibre and 16·46 per cent. of silica, thus showing its gritty and indigestible character.

(*b*) In a second instance a material of very similar nature had been sold as "Rice Flour" at 11*l.* 10*s.* per ton. It contained 23·71 per cent. of woody fibre and 10·5 per cent. of silica.

(*c*) Another product of rice was the following, a refuse material obtained, I was informed, in the manufacture of cordite :—

	Per cent.
Water	73·52
Oil	8·41
Albuminoids	13·62
Carbohydrates, &c.	2·52
Woody fibre	·85
Mineral matter	1·08
	100·00
Nitrogen	2·18

This was very wet and pasty. It cost 5*l.* per ton, a price which, seeing that nearly three-quarters of the material are water and that only 2½ per cent. of carbohydrates are present, is far in excess of its value. It soon became mouldy on keeping.

3. *Coffee Husks in Feeding Cake.*

A feeding cake sold in December, 1917, at 18*l.* 18*s.* 6*d.* per ton, was found to contain a quantity of coffee husks—a worthless ingredient for feeding use. This case occurred in Dorset.

4. *Middlings* (*adulterated*).

A sample of what had been sold as "Middlings" by a firm of corn merchants in Essex at 17*l.* per ton in April, 1918, was found on analysis, to contain—

Mineral matter	36·62
Including silica	33·53

It was not "middlings" at all, but just broken grain among which were wheat, barley, maize, and rice, and it contained a number of pieces of flint. The vendors took the material back on complaint being made.

5. *Castor-oil Bean in Pig Meal.*

In a sample supplied as "Pig Food" and sent to a large estate in Oxfordshire I found that a quantity of ground castor-oil bean had been mixed with the other ingredients.

6. *Salt in Feeding Materials.*

There exists a considerable amount of uncertainty as to the effect of salt upon animals, but it would appear very certain that salt may prove injurious to pigs and to poultry when given in excessive amounts. Cases which I have had brought to my notice strengthen this belief greatly. In one instance harm was done to pigs by feeding them on fish meal which had a large amount of salt in it. In another instance a food sold as "pig meal" was given to some young ducks. They had a meal of this when shut up, and next morning five out of the eight were dead. I found the meal to contain 7·29 per cent. of salt. It was prepared by a firm of millers in Shropshire, and was advertised as a food for pigs and poultry.

7. *Compound Feeding Meals.*

As the Table at the end of this report shows, a comparatively large proportion of the feeding stuffs sent me consisted of compound meals, this, as will have been gathered from my earlier remarks, being the most profitable form in which to sell feeding stuffs for stock, allowing as it did, not unfrequently, of the incorporation of materials of doubtful and useless nature. Numerous cases have been met with where the prices charged for such mixtures have been altogether out of reason. Instances are appended, and it will be observed that in some of these I was able to separate and estimate the different ingredients and see what their proper "controlled" price would be.

(*a*) A member residing in Hampshire sent a sample of a feeding stuff supplied by a local firm at the price of 25*l.* 6*s.* 8*d.* per ton. I found it to consist mainly of oat and barley husks with malt culms, and some palm-nut meal and bean meal. Had this been sold according to the "controlled price" for "compound meals," not more than 17*l.* 7*s.* 6*d.* per ton could have been charged, independently of carriage, &c., but by calling it "Pig Food," and including articles not scheduled in any Orders, the vendor was able to charge what he did.

(*b*) A sample of "Laying Meal," sold in Northumberland, at 20*l.* per ton, was found to consist of wheat, barley, and maize, with hay chaff and weed seeds, and to contain 12·56 per cent. of sand.

(*c*) A "Poultry Mixture" made up as follows :—Oats 33 parts, wheat 25 parts, maize 5 parts, weed seeds 35 parts, sand 2 parts, was sold in Suffolk to a member at 32*l.* 10*s.* per ton!

(*d*) A member in Northamptonshire sent me a sample of "Hen Food" which he had purchased at the cost of 6*l.* 10*s.* a quarter. It turned out to be made up of oats 72 parts, maize 24 parts, wheat 4 parts, and the "controlled price" would have been at most 60*s.* a quarter, or less than one half of what was charged.

(*e*) A sample of "Horse Mixture" sold by a south country firm, to take the place of oats for horses, was examined by me on behalf of a member, and was found to be composed of cotton cake 10 parts, oat husks 45 parts, and malt culms 45 parts. The price was 28*s.* 6*d.* per cwt., and, taking the "controlled" figures for cotton cake and malt culms, and allowing even 4*l.* a ton (much above its value) for the oat husks, the cost worked out at 10*s.* a cwt. at most.

(*f*) "Horse Meal" obtained through a Yorkshire Agricultural Trading Society, and costing 18*l.* 17*s.* 6*d.* per ton, consisted of three-quarters palm-nut meal and one quarter cotton cake meal. The cost under the controlled prices for the ingredients employed should have been 13*l.* 18*s.* 9*d.* per ton only.

The following cases refer to feeding stuffs sold as compound meals, but composed, to all intents, of palm-nut meal only :—

(*g*) A "special meal," made in Liverpool, was charged at 18*l.* 2*s.* 6*d.* per ton, carriage, &c., extra, and was found to be practically palm-nut meal to which a little oats had been added, and the whole sweetened.

(*h*) A "pig meal" invoiced from Hull, at 18*l.* per ton, was simply palm-nut meal, and should have been charged at the controlled price of 13*l.* 5*s.* per ton.

8. *Dried Milk.*

Two samples of dried milk, damaged and unfit for human consumption, and used for pig-feeding, gave the following analyses :—

	A	B
Water	5·82	7·15
Fat	24·70	19·36
Casein	24·63	26·31
Milk-sugar, &c.	40·18	41·27
Mineral matter	4·67	5·91
	100·00	100·00
Nitrogen	3·94	4·21

This should make a very useful food for pigs.

9. *Carrageen Moss* (*Seaweed*).

It may be of interest to give the analysis of a sample of carrageen moss which was sent to me. The seaweed was collected in co. Donegal, and is used, locally, I was informed, for human food :—

	On dried (water-free) sample Per cent.
Oil	·20
Albuminoids	13·56
Carbohydrates, &c.	68·99
Woody fibre	2·59
[1]Mineral matter	14·66
	100·00
Nitrogen	2·17
[1]Including sand	·06
,, salt	·20

This was very clean, had but little salt, and undoubtedly possessed high feeding properties.

B. Fertilisers.

There is practically nothing of interest to record as regards phosphatic and nitrogenous materials, the quality and price alike of these being under control, and they have, with but few exceptions, turned out satisfactory. A few samples of fish meal and meat meal were sent, but very few compound manures. Refuse materials, for manurial purposes, however, came more to the fore.

1. *Flue Dust.*

Several samples of this have been sent, the results showing the variable nature of the material according to the source from which it has come. These have, as a rule, been alkaline in character, and it would not be advisable to mix them with sulphate of ammonia. Constituents injurious to crops have, however, but seldom been present. The following are analyses of some samples sent :—

	A	B	C	D	E	F
	Blast furnace dust		Flue dust			
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	21·96	23·09	1·96	10·25	7·95	9·98
Oxide of iron and alumina	33·55	—	39·50	—	—	—
Lime	7·90	—	6·21	—	—	—
Silica	18·48	20·34	48·50	31·83	37·42	47·36
Potash	7·82	7·70	5·99	2·23	·40	·37
Equal to sulphate of potash	14·47	14·25	11·09	4·12	·74	·68
Potash soluble in water	—	—	2·65	—	—	—
Equal to sulphate of potash	—	—	4·90	—	—	—

"B" cost 5*l.* a ton.

"C" was made at Middlesbrough, and the cost was stated to be only 30*s.* per ton, which must be considered extremely low. It contained some ferrous salts.

"E" and "F" were simply scrapings from ordinary flues in engine works and collieries, and were practically of no value as sources of potash.

2. *Refuse Manures.*

(*a*) Organic manure.

(*b*) Tannery refuse.

(*a*) As a rule, manures known under names such as "Organic Manure," "Sewage Manure," "Natural Manure," and the like, are of very uncertain nature and value. Occasionally, however, some quite fair ones are met with. One of these was the following, sold at 40*s.* per ton in bulk on rail, less 5 per cent. for cash.

	Per cent.
Moisture	6·31
Organic matter	56·07
[1]Phosphoric acid	·70
Lime	2·04
Oxide of iron and alumina	5·09
Alkalies, &c.	3·17
Insoluble siliceous matter	26·62
	100·00
Nitrogen	3·41
Equal to ammonia	4·14
[1]Equal to phosphate of lime	1·53

This was very dry and in nice fine condition, and certainly could not be called dear. It should prove quite a good substitute for farmyard manure where this is not obtainable.

(*b*) A sample of tannery refuse gave the following analysis:

	Per cent.
Moisture	28·69
Organic matter	7·30
Oxide of iron and alumina	1·23
Lime	41·92
Phosphoric acid	·18
Carbonic acid, &c.	17·32
Sand	3·36
	100·00
Nitrogen	·53
Equal to ammonia	·64

This, for land that wants liming, would be quite useful, and, as it could be carted away free, the difficulty of its being in wet condition and difficult to apply would be worth getting over by making it up into a compost heap.

3. *Leather.*

A considerable amount of attention has been paid of late to the utilisation of waste leather, and the fact that from army stores there comes a large supply of this material makes it very desirable that this should, if possible, be made use of. Unfortunately, though it contains a considerable amount of nitrogen, the nitrogen is not, in the ordinary way, available for crop purposes, for, as is well known, leather will lie long in the land without being appreciably affected. So it has come about that, in this country at least, it has been looked upon largely as an adulterant of manures, used to make them show a higher percentage of nitrogen. Whether, however, the softer kinds of leather, or the leather ground into fine powder, may not be more effectual is a point that might well be investigated, and in the United States of America, at least, there seems to be a ready sale for it. Processes have been devised for the purpose of rendering the nitrogen in leather available, and, though these have not as yet been successful in putting on the market a material of undoubted agricultural value, the subject is one well worth pursuing.

4. *Lime.*

The ploughing up of so much grass land throughout the country has directed attention afresh to the subject of liming land, and there are, as I have already observed, few matters of such agricultural importance. Unfortunately the price of lime has gone up very considerably, as also the cost of labour to cart and distribute it. Another point is the difficulty of getting lime of good and reliable quality, and, lime not being comprised under the Fertilisers and Feeding Stuffs Act, the vendors are not obliged to give a guarantee of quality, and, indeed, will seldom do so. It is well, therefore, that before an extensive purchase of lime is made, a sample should be submitted for analysis. In several cases that have come to my notice lime has been supplied which was not derived from carboniferous limestone or chalk, thus consisting almost entirely of lime, but was largely magnesian also in character. The following are examples of this :—

	A	B	C
	Per cent.	Per cent.	Per cent.
Oxide of iron and alumina .	12·25	10·93	11·02
Lime	49·25	42·80	41·54
Magnesia	25·95	24·29	20·58
Silica	5·47	12·22	8·54
Water, carbonic acid, &c. .	7·08	9·76	18·32
	100·00	100·00	100·00

"A" was sold as "agricultural lime" and cost 45*s.* per ton.

"B" was Breedon ground lime costing 33*s.* 9*d.* per ton delivered.

"C" was also Breedon lime, the price being 37*s.* 1*d.* per ton delivered.

All these three were "magnesian limes" and not suitable for the liming of agricultural land.

C. Miscellaneous.

Soft Soap.

A sample of soft soap was sent to me by a Member who wished to know if it would be a safe one to use for washing hops. It was known as the "Paragon" soap and was stated to contain 25 per cent. of fatty acids, and to be a soap of "the very highest order." An analysis of it gave :—

	Per cent.
Water	90·87
Fatty acids	6·76
Alkali, salts, &c.	2·37
	100·00

This, accordingly, was very different to what was stated, there being only 6¾ per cent. of fatty acids in place of 25 per cent., and, as it contained over 90 per cent. of water, it was at the price charged for it—viz., 38*l.* a ton—an extravagantly high-priced article.

The following is the list of samples submitted to me by Members during the twelve months December 1, 1917, to November 30, 1918 :—

Linseed cakes and meals	2
Undecorticated cotton cakes	2
Compound feeding cakes and meals	64
Palm-nut cakes	4
Ground-nut cakes	4
Rape cakes	10
Sesame cakes	2
Maize meals	3
Rice meals	2
Cereals, offals, &c.	17
Superphosphates	7
Dissolved bones	1
Compound manures	7
Raw and steamed bones	5
Meat meal	6
Fish meal	4
Basic slag	13
Nitrate of soda	1
Sulphate of ammonia	11

Flue dust	18
Potash materials	3
Shoddy, wool dust, &c.	27
Refuse manures	17
Lime, chalk, &c.	15
Waters	16
Milk and butter	29
Soils	46
Miscellaneous	5
Total	341

J. Augustus Voelcker.

1 Tudor Street, E.C.
December, 1918.

ANNUAL REPORT FOR 1918 OF THE BOTANIST.

The two outstanding features of the work in the Botanical Department during 1918 were the falling off in the number of seed samples received for testing, and the demand for information concerning the cropping capacity of the different varieties of the cereals, more especially of wheat. Fungoid diseases of the two great food crops, potatoes and wheat, attracted more attention than usual, but hardly any inquiries were made concerning the diseases of garden vegetables. Questions regarding temporary and permanent grass land, apart from the identification of troublesome weeds in the latter, were less frequent than in the two previous seasons.

Seed Testing.

The number of samples received for testing was approximately half that of the previous year (96 compared with 184). The diminution in numbers was due to the fact that the Testing of Seeds Order requires all seed merchants to give a guarantee of the purity and germination of the majority of the kinds of agricultural seeds they deal in. Analyses consequently serve only as a check on the seed merchant's statements, and they are no longer necessary for determining the relative values of samples, or for estimating the quantities of seed to be sown. In all probability this branch of the Department's activity will diminish in importance still further. Hitherto, particularly in the hands of Mr. Carruthers, the former Botanist to the Society, it has played an important part in the development of agriculture. His insistence on the necessity for pure seed of good germinating

capacity did much to stimulate the demand for it, and concurrently with his propagandist efforts one can trace a steady improvement in the quality of farm seeds, especially those of the grasses and clovers. In time the recognition of the fact that badly cleaned seeds are bad from all points of view would have forced all seed dealers to follow the example set by the leading seed merchants of this country, and the fouling of land through the deliberate sowing of weed seeds would have ceased. The date has been hastened by the action of the Food Production Department in providing all agriculturists with opportunities for seed testing very similar to those which members of the Society have possessed for the past thirty years.

Of the seeds tested in the past season about half were those of cereals ; clovers and roots formed the bulk of the remainder, the whole group of grasses being only represented by about a dozen samples.

At harvest three cases of mal-deliveries of seed (two barley and one wheat) were reported. In each case the merchants supplying the seed admitted liability, and satisfactory compensation was obtained.

Fungoid Diseases of Plants.

Blight or *Potato Disease* (27 inquiries).—The disease was abundant throughout the country, and caused, in the aggregate, large losses. Varieties which were lifted early in the season escaped lightly, but mid-season and late varieties, especially the latter, were generally badly attacked. In fact several cases were reported where the loss at lifting time exceeded 10 per cent. of the crop. "After-sickness" or rotting in the clamps has already (November) been serious, and it will probably prove still more so owing to the prevalence of disease and the bad conditions under which much of the crop has been lifted and stored. In one case reported on it had set in in a clamp of British Queen at the end of October, and rendered most of the tubers unfit for sale.

The varieties which have suffered most from disease appear to be Up-to-Date, King Edward, and Arran Chief. Evergood, though attacked by disease, has not been damaged to anything like the same extent.

Spraying with Bordeaux or with Burgundy mixture has undoubtedly been beneficial, though it has not invariably prevented decay from starting in the tubers.

No specimens of the Wart Disease were received by the Department, but it is known that a number of fresh outbreaks have occurred in the country. The position with regard to this pest has become serious and its gradual advance towards the

great potato-growing districts of the eastern counties is much to be feared.

Diseases of Cereals (32 inquiries).—The over-average yield of the cereal crops during the past season was not due to any appreciable lack of fungoid pests. Rust was very prevalent on wheat in the early part of the year, and there seemed to be a likelihood of its doing more damage than usual. For a time, however, it did not spread much and the crops appeared to be "growing away" from it, but as they came into ear the amount of rust increased, especially on the richest soils. Most of the rust in the country was, as usual, the yellow rust (*Puccinia glumarum*) but two of the ten diseased plants reported on were attacked by the black rust (*Puccinia graminis*).

Bunt or Stinking Smut was more abundant than usually. The spores of the fungus were found in three samples of seed sent for germination tests and one crop was inspected in which about a third of the ears were filled with bunted grains.

In view of its prevalence and the difficulty of detecting the spores in well-cleaned seed samples, purchased grain should invariably be dressed with copper sulphate before drilling, and the same course should be adopted with home grown seed unless one can be certain that it is from a clean crop which has not been contaminated by a travelling threshing machine. The treatment is so efficacious that there is no excuse for a bunted crop. The Loose Smut of wheat was also common. This is difficult to cope with, and where present it is best dealt with by a change of seed.

Mildew was reported on all of the cereals, but serious damage was only complained of in two cases, both on wheat in Cheshire.

No examples of the minor diseases so characteristic of the season of 1916 were sent in for examination.

Diseases of Roots (8 inquiries).—A bad case of the rotting of yellow globe mangolds in the clamp during February proved to be due to Botrytis. The rapidity with which the rot spread was probably due to the fact that the crop had been lifted late in the season and had been exposed to frosts. Reports were made on rust in mangolds and finger-and-toe, soft rot and mildew in swedes.

Diseases of Leguminous Crops (9 inquiries).—With the exception of an epidemic of bean-rust all of the reports dealt with clover-sickness in broad red clover or in sainfoin.

Diseases of Fruit-trees (22 inquiries).—The diseases reported on most frequently were scab and canker on apples, brown rot on apples and plums, and rust on plums. Two sets of specimens of the "glassy disease" of apples, both Allington Pippins, were sent for examination. The cause of the disease

is obscure. Where present portions, or even the entire fruits, become almost transparent and glass-like.

Weeds.

The (58) specimens of weeds identified were very similar to those of the preceding season. They included no plants of special interest. The common spurrey was again sent in for identification more frequently than any other weed. It is probable that the extended use of ammonium sulphate on light soils disposed to sourness will further increase the spread of this over-abundant species. Where signs of this occur heavy dressings of lime will go far towards keeping it down.

One case of poisoning by meadow-saffron was reported during the season. Twenty yearlings had been feeding in a field containing this plant for some three weeks with, apparently, no bad results. Then, one day, about half of them were taken ill and three of them died. Attempts had been made to eradicate the weed but it was present in too great an abundance for digging out to make much impression on it. It seems possible that the deeply placed bulbs could be destroyed by driving a slender crowbar into the hearts of the plants and dropping a spoonful of rough salt into the hole. If the method was found to prove successful it would be less laborious than digging out the plants.

A second case where young stock were poisoned through feeding on the foliage of recently felled oaks was also reported.

General Inquiries.

The bulk of inquiries under this heading (74) had reference to the wheat crop, and were of little general interest. Information regarding Spring wheats was again in demand, mainly with regard to varieties suitable for the latest sowings.

Useful reports on the behaviour of the previous season's crop were received from members in various parts of the country, but more especially from the southern portions. They agree generally in recognising the value of varieties suitable for spring planting when it has been impracticable to sow on a sufficient scale in the autumn, and also to follow roots folded off by sheep. Only one yield lower than 30·5 bushels, the average of all available data (see Vol. 76, p. 48), was mentioned, but this can hardly be taken to represent the real position with any accuracy. Yields of over 40 bushels per acre were almost equally rare.

Two failures through the "running" of the crop were recorded against Red Nursery Wheat. In each case it was sown towards the end of April instead of before the middle of the month. On the other hand a sowing made on April 26th in

Hampshire, gave the satisfactory crop of 40 bushels per acre. Failures with spring sowings of autumn varieties have been more numerous, but none were reported where the crop had been drilled by the middle of February. Amongst these were the following :—Standard Red, sown about March 1st (Kent), a failure, but sown on February 27th (Hampshire), a satisfactory crop. Benefactor, sown during the first week in March, failures in Gloucestershire, Glamorganshire, Essex, and Lincolnshire. Browick, sown in second week of March, a failure in Cambridgeshire. Square Head's Master, first week in March and "March sown," failures in Yorkshire, Lincolnshire, and Cambridgeshire. But the existing data are still far too scanty for any determination, if such be possible, of the latest date at which any of these varieties can be sown with a reasonable prospect of securing a crop.

R. H. Biffen.

December 1, 1918.

ANNUAL REPORT FOR 1918 OF THE ZOOLOGIST.

The numerous applications for advice received during the past year have for the most part concerned insects already well known, and there is therefore little need for a lengthy report. Most of the common pests have been inquired about, and some have been unusually destructive. In the case of fruit pests, their ravages were in some cases quite dwarfed by the failure due to weather influences, but caterpillar attacks were severe on trees which did bear fruit, and other insect enemies are responsible for considerable reduction of crop.

Among the insects sent for identification were many animal parasites in connection with R.A.M.C. work. The scope of the year's work is indicated by the following notes, arranged under the headings of the various crops.

Cereals.—In addition to wireworm and leather-jacket, which are dealt with in a separate paragraph, complaints were received of slugs, surface-caterpillars, frit-fly, wheat bulb-fly, thrips, and of two rare pests, a flea-beetle on barley, and a caterpillar eating the grain of wheat.

Slugs were accused of causing much damage to wheat and oats in the early part of the year. Fritfly was, on the whole, less destructive than in 1917, but there were some bad cases. It was rarely, however, that March-sown oats failed from this cause, and experience once more emphasised the importance of sowing oats as early as possible.

Wheat bulb-fly attacks were, perhaps, less widely spread than usual, but they were severe in places. In connection with this pest it is always hoped that a close study of the cropping of the land during the previous season will give a clue to the proper cultural methods to prevent its occurrence, but the results are often contradictory, and it is difficult to draw any valid conclusions from the observations made. Dr. Imms reports that on a field which had been cropped partly in bulbs and partly in potatoes the previous year, the bulb area was quite free from wheat bulb-fly, while the potato area was badly affected ; and on another field which had borne oats in one part and potatoes with a little beet in another, the oat area was hardly affected by wheat bulb-fly, while the remainder of the field suffered severely. The wet weather of the late summer was observed in some districts to be very fatal to the mature insects of the wheat bulb-fly, few of which were to be found even where their grubs had been exceedingly plentiful. It is to be hoped that the attacks next year will in consequence be less severe.

The flea-beetle which has been alluded to is a species named *Phyllotreta vittula*, which attacks barley. Though a recognised pest on the Continent, it has very seldom been observed in England, but this year it was distinctly injurious to certain barley crops, damaging the leaf blades to such an extent that the yield was materially reduced. It is evident that a watch must be kept on this insect for the future.

The caterpillar observed attacking the grain of wheat in some localities was that of the moth *Hadena basilinea*, first noticed, I think, by Dr. Somerville a few years ago. So far its ravages were not very important, but its recurrence deserves noting.

Grass.—The grass-moth, *Chaereas graminis*, made another appearance this year, the Macclesfield district being the centre of attack. This insect, which is essentially an inhabitant of high pastures, and seldom occurs at an altitude of less than 750 ft., is very alarming on account of the vast number of caterpillars which suddenly make their appearance and crawl over the ground in search of new food, and it is our nearest approach to such a wholesale invasion as a locust attack in warmer countries. Usually the harm done is much less than is anticipated at the time of its onset, because high-class lowland pastures do not suffer, but in the present instance it caused severe loss, especially in the milk yield, which was estimated to be only one quarter of the normal in the district affected.

The fact that it has never been known to recur in the same locality till after an interval of many years renders the use of preventive measures undesirable. There is no object in expending money in anticipating an attack which all experience shows is in the highest degree unlikely. Appropriate measures

for confining the attack within reasonable limits when it does occur can only be taken by those on the spot, and the assistance of Dr. Imms and other experts was of great use in the present instance.

Two circumstances are held to have been partly responsible for the severity of the ravages of this pest during the past two years. Two severe winters greatly reduced the number of small birds which would naturally prey on the caterpillars, and war conditions prevented the firing of the high grass lands, a measure which in normal times no doubt assists largely in keeping the moth in check. The latter consideration is now, happily, no longer operative, and it may be hoped that next year the grass-moth will not figure in our list of destructive insects.

Roots.—Surface caterpillars did much harm to various root crops this year, and turnip-fly attacks were also very severe. There were an unusual number of complaints of mangold-fly, and the experience of one observer is worth noting. On one field a portion bearing mangolds alone was badly attacked, while another portion on which the mangolds were mingled with swedes entirely escaped.

In some districts mangolds were severely attacked by the black bean aphis. Another pest rather widely complained of in turnips and cabbages was the gall-weevil, and a good deal of turnip seed was destroyed by the turnip seed weevil.

Peas and Beans.—The *Sitones* weevils so destructive to these crops last year were not nearly so often the subject of complaint, but a few bad attacks were recorded. The bean aphis was particularly harmful, and did a great deal of damage, the drought of the early summer being especially favourable to this pest.

Cabbage, Cauliflower, &c.—The first broods of the various cabbage caterpillars were less destructive than last year, but the second broods did much harm in some localities. Their distribution and incidence was very irregular, and difficult to account for. Especially was this the case with the large white butterfly, which would be practically absent in one garden or allotment and highly destructive in one near by. Generally speaking the small white and the cabbage moth were the most widely spread and injurious, and a good many examples of a fourth caterpillar, which is probably that of the "Garden Pearl," *Pionea forficalis*, were found attacking various species of *Brassica*. Beyond hand-picking, favourable reports were received of the use of salt solution, and of "Belumnite," in the attempts to get rid of the caterpillar.

Fruit.—Fruit pests were unusually destructive, though in some districts the utter failure of plums and pears, and

the partial loss of the apple crop through the spring frosts somewhat masked their work. Caterpillar attacks were especially noticeable, many moths such as the Lackey, the Vapourer, the Gold Tail—as well as the ubiquitous Winter Moth—being unusually abundant, and taking much toll of the trees spared by the weather. Various species of aphis were also very destructive, and Capsid bugs damaged the apples and reduced the crop in some localities, while apple blossom weevil also did much harm. Bush-fruit suffered also. There was little Magpie moth in currants and gooseberries, but many bad attacks of the Saw-fly, and also of Red Spider. Raspberries and loganberries suffered from the beetle, and there were some complaints of the bud-moth, while the Strawberry moth reappeared in the old localities.

Forest Pests.—The inquiries in this section were not numerous, nor did they bring out anything of special interest. The outstanding forest pest of the year was certainly the oak tortrix which made one of its periodic attacks in force, and was reported from several districts. There was some complaint of the pine weevil, and specimens of injury due to other insects were sometimes sent for identification, the sender, however, often adding that lack of labour would prevent any serious steps being taken in the matter. It is clear that during the war there has been little possibility of paying adequate attention to the insect enemies of the forest trees, and a development of this department of the Zoologist's work may be expected in the future.

Wireworm and Leather-jacket.

These two exceedingly well-known underground pests have attracted a great deal of attention during the past three years on account of the large amount of grass land broken up on farms and allotments. Their wide range of food-plants is indicated by the fact that both were complained of in 1918 on wheat, oats, beans, potatoes, mangolds and swedes, while wireworms also attacked beet, and leather-jackets mustard and flax. Both pests, as a rule, swarm in grass land, so that it is not surprising that such land, if broken up without any attempt to clean it, should be exceedingly unfavourable to the following crops. But corn crops have a double disadvantage. They are most subject to total destruction, and their cultivation does not clean the ground, as is more or less the case with potatoes or roots.

In the monthly reports of various experts to the Food Production Committee there are some interesting observations on these insects. Portions of three fields near Newport, Salop,

were examined and the number of wireworms and leather-jackets in the soil estimated per acre. Of wireworm the lowest number was 215,000 and the highest 510,000 per acre, while the leather-jackets ranged from 13,000 to 220,000 per acre. Moreover, no tendency to burrow deeply into the soil on account of cold was observed, for though the first count was taken immediately after eighteen degrees of frost, the wireworms were practically all within one and a half inches of the surface, and the leather-jackets seldom more than one inch deep. This observation, as far as it goes, appears strongly in favour of the measure of paring and burning the surface soil wherever possible. Mr. Mosley instances a case where this treatment was very successful last May on a plot selected in the middle of an allotment area very badly infested, where crops on all the untreated portion were partial or complete failures.

The value of thorough rolling and consolidation of the ground after seeding was often manifest last spring in infested ground, the damage to the crop being thereby much reduced.

Miscellaneous Notes.

Among specimens sent for identification have been a large number of ticks, most of them from the Colonies. In this country ticks are of no great importance, but the matter is far otherwise in warmer climates. Their very numbers make them a serious trouble as parasites on cattle and sheep, but quite apart from the general loss of condition due to the presence of hosts of blood-sucking parasites, several species are now known to convey to man and domestic animals definite diseases of a very fatal nature. Our knowledge in this field has been greatly extended of late years, and very much has been done in many parts of the world to lessen the evil wrought by these pests on cattle, sheep, horses, &c., extensive regions having been cleared by the combined methods of dipping the animals and quarantining the infested land. This department has, of course, not been concerned with the medical aspect of the case, but it has been able to give some assistance from the entomological side.

Two rather curious cases were brought to my notice for which I could find no explanation, and they are mentioned here in the hope that some member of the Society may be able to throw light upon them.

A farmer complained that his ducks were laying eggs which were unmarketable because the yolks were of a dark green colour. When broken into a bowl they looked precisely like green plums floating in the fluid albumen, though the eggs

were newly laid. It seemed likely that the food was at fault, and indeed I found that there was a belief in some quarters that such discolouration was sometimes due to the ducks eating acorns, but in the present case there were no oak-trees at hand. Happily only a few batches of eggs were affected, when matters became normal again.

The second case concerned tomatoes, the trouble being that the fruit absolutely refused to ripen on the under side, however much exposed to the sun, so that quite a quarter of it remained hard and uneatable when the rest was fully ripe. There was no sign of disease, and the fruit was exceptionally fine. My correspondent had consulted me on the matter in the spring because of his experience of the previous year, and I then suggested that he should send me specimens later on if the trouble recurred. Examples reached me in September, and they were affected exactly as described.

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THE WOBURN EXPERIMENTAL STATION OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

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FIELD EXPERIMENTS, 1918.

THE season 1917-18 was no more favourable, agriculturally, than its predecessor. After harvest a very wet October followed, this continuing to early November, and much delaying the winter sowings. The later part of November and all December

were, however, dry and occasionally frosty, and enabled operations to go on well. There was much rain, with milder weather, towards the end of January, but February and March were ideal months, and gave promise of an early spring. April, however, was very wet and cold, and checked the progress, which, however, was righted again by a favourable May. But in June there was a prolonged drought, and, though it was favourable to haymaking, it caused great difficulty in the sowing of root crops, while corn crops suffered much also on the light lands. Only ·61 in. of rain fell this month. July was wet and unseasonable, and delayed the ripening of corn crops, besides making the in-gathering of late hay very difficult. August was quite a good harvest month, and the greater part of the corn crops were got in, but an exceedingly wet September (rainfall 6 in.) delayed the harvesting of the later crops.

Though the total rainfall for the twelve months (26·57 in.) was nearly 3 in. less than in 1916-17, there were just as many rainy days (177).

Of the corn crops, wheat yielded well, barley less so, and oats were distinctly inferior. The hay crop was very good, but root crops were very difficult to grow. A capital potato yield was, however, obtained, and, with care, a quite good crop of mangolds for the land was secured.

Continuous Growing of Wheat (*Stackyard Field*) 1918 (42nd Season).

The several cultivation operations were carried out as follows :—

1917, Oct. 18—Farmyard manure applied to plot 11b, 9 tons 2 cwt. 3 qr. 24 lb. per acre, the manure containing ·402 per cent. of nitrogen.

,, Oct. 26—"Little Joss" wheat drilled, 9 pecks per acre, the seed being dressed with sulphate of copper. Mineral manures were applied the same day.

1918, Jan. 4—Lime, ½ ton per acre, was put on plots 8aa, 8bb.

,, May 7—Rape dust sown on plot 10b, 450 lb. per acre ; contained 4·58 per cent. of nitrogen.

,, May 7—Nitrogenous top-dressings (sulphate of ammonia and nitrate of soda) applied.

,, May 21—Second applications of nitrogenous top-dressings.

,, Aug. 15—Wheat cut.

,, Sept. 24—Wheat carted and stacked.

,, Oct. 2—Wheat threshed.

,, Nov. 9—Corn dressed and weighed.

The wheat looked very well at the end of November, and even stood the drought of June very fairly, but the wet weather of July delayed the ripening, and, even after it was cut, the continued bad weather in September prevented its being carted, and a good deal of the grain began to "sprout."

The harvest results are given in Table I., page 266.

Notwithstanding the difficulties in securing it, the wheat crop was a distinctly good one for the continuous plots. The unmanured produce was 14 bushels of corn, with $12\frac{1}{2}$ cwt. of straw per acre, a remarkable result, seeing that wheat had been grown for forty-two years on the same land and without any manure. This was $1\frac{1}{2}$ bushels of corn and $5\frac{1}{2}$ cwt. of straw more than the same land had yielded in 1917.

Mineral manures (plot 4) gave, as usual, but slightly more corn (·6 bushels only) than no manure.

Sulphate of ammonia produced, on the whole, quite as good crops as nitrate of soda. Where 2 tons of lime per acre had been applied once, and as far back as 1897 (plot 2b), the remarkable yield of 19·6 bushels per acre of corn was obtained though the plot similarly treated with sulphate of ammonia, but without any lime (plot 2a), failed to produce any crop whatever. Once again the seemingly contradictory result with 4 tons of lime (plot 2bb) was produced, the crop being 4 bushels less than on 2b, and nearly 2 bushels less than on plot 2aa, where 1 ton of lime only had been given.

Plot 5a continues to show that lime is not yet urgently required, though the increase of 6·4 bushels on plot 5b illustrates the advantage of using 1 ton of lime per acre, even when minerals are used with sulphate of ammonia. The crop here—28·3 bushels—was, indeed, the highest one of all the plots, though rape dust (plot 10b) was only a shade behind it (28·1 bushels), and gave more straw. It had been decided to re-lime plots 8aa and 8bb with 10 cwt. of lime per acre, and the result of this was already seen in the larger crops as compared with 8a and 8b.

Nitrate of soda gave crops no better than with sulphate of ammonia, if as good. Used alone, the double dressing (plot 3a) produced 2·5 bushels per acre more than the single one (plot 3b), and when minerals were used also 1·4 bushels more (plots 6 and 9a), the results being, on the whole, lower than those similarly obtained with sulphate of ammonia when lime had been given (plots 5b, 8aa).

Farmyard manure (plot 11b) was slightly inferior to rape dust (plot 10b), but gave the highest straw yield of the series. The crop with rape dust looked, all through, exceedingly well, the result being specially remarkable in view of the comparative failure of rape dust to benefit the barley crop. As stated, it

TABLE I.—*Continuous Growing of Wheat*, 1918 (*42nd Season*).

(Wheat grown year after year on the same land, the manures being applied every year.)

Stackyard Field—Produce per acre.

Plot	Manures per acre	Head corn		Tail corn	Straw, chaff, &c.
		No. of bush.	Weight per bushel	Weight	
			Lb.	Lb.	C. q. lb.
1	Unmanured	13·6	55·2	9	12 1 15
2a	Sulphate of ammonia (=25 lb. ammonia)	—	—	4	1 0 1
2aa	As 2a, with 5 cwt. lime, Jan., 1905, repeated 1909, 1910 and 1911	17·4	55·2	16	15 1 4
2b	As 2a, with 2 tons lime, Dec., 1897	19·6	56·0	16	14 0 15
2bb	As 2b, with 2 tons lime (repeated), Jan., 1905	15·6	56·0	16	12 1 6
3a	Nitrate of soda (=50 lb. ammonia)	20·1	56·4	16	18 2 9
3b	Nitrate of soda (=25 lb. ammonia)	17·6	56·0	20	16 0 8
4	Mineral manures (superphosphate, 3 cwt.; sulphate of potash, ½ cwt.)	14·6	55·5	9	14 1 7
5a	Mineral manures and sulphate of ammonia (=25 lb. ammonia)	21·9	56·5	12	17 3 17
5b	As 5a, with 1 ton lime, Jan., 1905	28·3	59·2	22	21 3 11
6	Mineral manures and nitrate of soda (=25 lb. ammonia)	22·3	56·0	32	19 2 8
7	Unmanured	14·4	55·8	16	12 2 23
8a	Mineral manures and (in alternate years) sulphate of ammonia (=50 lb. ammonia)	11·0	59·0	12	9 0 8
8aa	As 8a, with 10 cwt. lime, Jan., 1905, repeated Jan., 1918	22·5	61·0	16	18 1 19
8b	Mineral manures, sulphate of ammonia (=50 lb. ammonia) omitted (in alternate years)	7·9	59·0	12	6 1 5
8bb	As 8b, with 10 cwt. lime, Jan., 1905, repeated Jan., 1918	16·5	59·5	16	12 1 28
9a	Mineral manures and (in alternate years) nitrate of soda (=50 lb. ammonia)	23·7	57·0	20	19 3 22
9b	Mineral manures, nitrate of soda (=50 lb. ammonia) omitted (in alternate years)	10·2	56·5	12	8 3 21
10a	Superphosphate 3 cwt., nitrate of soda (=25 lb. ammonia)	15·5	56·7	12	12 2 18
10b	Rape dust (=25 lb. ammonia)	28·1	58·2	14	24 3 5
11a	Sulphate of potash 1 cwt., nitrate of soda (=25 lb. ammonia)	12·9	58·5	10	10 2 17
11b	Farmyard manure (=100 lb. ammonia)	26·5	57·7	24	25 1 10

TABLE II.—*Continuous Growing of Barley*, 1918 (*42nd Season*).

(Barley grown year after year on the same land, the manures being applied every year.)

Stackyard Field—Produce per acre.

Plot	Manures per acre	Head corn		Tail corn	Straw, chaff, &c.
		No. of bush.	Weight per bush.	Weight	
			Lb.	Lb.	C. q. lb.
1	Unmanured	9·1	51·7	17	6 1 6
2a	Sulphate of ammonia (=25 lb. ammonia)	—	—	—	1 2 5
2aa	As 2a, with 5 cwt. lime, Mar., 1905, repeated 1909, 1910 and 1912	5·3	54·7	8	3 1 3
2b	As 2a, with 2 tons lime, Dec., 1897, repeated 1912	15·0	55·0	32	9 3 16
2bb	As 2a, with 2 tons lime, Dec., 1897, repeated Mar., 1905	6·6	54·2	16	4 0 27
3a	Nitrate of soda (=50 lb. ammonia)	18·7	50·8	25	10 3 26
3b	Nitrate of soda (=25 lb. ammonia)	7·2	53·5	8	3 3 0
4a	Mineral manures[1]	6·0	54·2	10	6 0 14
4b	As 4a, with 1 ton lime, 1915	9·8	50·2	4	6 1 22
5a	Mineral manures and sulphate of ammonia (=25 lb. ammonia)	—	—	—	2 0 22
5aa	As 5a, with 1 ton lime, Mar., 1905, repeated 1916	14·5	53·5	8	7 1 26
5b	As 5a, with 2 tons lime, Dec., 1897, repeated 1912	17·4	52·1	6	9 2 1
6	Mineral manures and nitrate of soda (=25 lb. ammonia)	21·2	51·6	7	10 0 27
7	Unmanured	8·1	51·6	3	4 0 20
8a	Mineral manures and (in alternate years) sulphate of ammonia (=50 lb. ammonia)	2·3	53·5	4	1 1 1
8aa	As 8a, with 2 tons lime, Dec., 1897, repeated 1912	22·1	52·2	8	11 0 13
8b	Mineral manures, sulphate of ammonia (=50 lb. ammonia) omitted (in alternate years)	—	—	—	0 1 20
8bb	As 8b, with 2 tons lime, Dec., 1897, repeated 1912	10·6	53·9	8	6 3 22
9a	Mineral manures and (in alternate years) nitrate of soda (=50 lb. ammonia)	27·0	52·6	8	13 3 15
9b	Mineral manures, nitrate of soda (=50 lb. ammonia) omitted (in alternate years)	17·8	51·9	6	8 1 11
10a	Superphosphate 3 cwt., nitrate of soda (=25 lb. ammonia)	24·3	51·4	6	12 0 21
10b	Rape dust (=25 lb. ammonia)	9·8	51·2	6	7 0 3
11a	Sulphate of potash 1 cwt., nitrate of soda (=25 lb. ammonia)	25·4	52·7	24	13 3 7
11b	Farmyard manure (=100 lb. ammonia)	35·1	52·9	33	19 3 26

[1] Superphosphate 3 cwt., sulphate of potash ½ cwt.

shared with plot 5b the credit of producing the best crop in the series.

As between the application of phosphates and of potash (plots 10a, 11a), there was a difference of 2·6 bushels in favour of phosphate, this being the reverse of what was noted in 1917.

Though harvesting was done under great difficulties through bad weather, and the corn had sprouted in parts, the amount of tail corn was not as high as in 1917, and was more in the case of the nitrate of soda plots than in any others.

Owing to the bad conditions, none of the corn was found, at time of valuing it, to be good enough for milling by itself. The least damaged lots were from plots 5b, 8a, 8aa, and 8b, singularly enough the plots on which sulphate of ammonia had been used. On a basis of 76*s*. per quarter for the year, these might have fetched 74*s*., but none of the other plots would have reached above 70*s*., and that only because of the scarcity of feeding materials.

Continuous Growing of Barley (*Stackyard Field*), 1918 (42nd Season).

Field operations were as follows :—

1918. March 20.—Farmyard manure applied (plot 11b), 8 tons 1 cwt. 2 qrs. 24 lb. per acre ; the manure containing ·431 per cent of nitrogen.
„ March 26.—"Chevalier" barley, 10 pecks per acre, sown. Mineral manures applied same day.
„ May 8.—Rape dust (containing 4·58 per cent of nitrogen) applied, also first top-dressings of nitrogenous salts (sulphate of ammonia and nitrate of soda).
„ May 21.—Second dressings of nitrogenous salts applied.
„ Aug. 23.—Barley cut.
„ Sept. 25.—Barley carted.
„ Dec. 24.—Barley threshed.
1919. Jan. 30.—Corn dressed and weighed.

The barley crop came up well and promised to be a better crop than usual. At the same time weeds made considerable encroachment, spurry in particular showing on plot 11a (not limed) and coltsfoot making its appearance on this plot also. The nitrate plots, on the whole, looked better than usual and superior to the sulphate of ammonia ones. The drought in June proved a great drawback, while the continuous rain of July caused the weeds to grow strongly, so that, when the crop was eventually cut on August 23, the presence of so much green growth at the foot of the sheaves prevented these drying readily, and it was found impossible to thresh the barley out

in the field, and it had to be carted home and stacked. Because of further difficulties in procuring threshing-tackle, the barley was not threshed out until December 24. It was dressed and weighed on January 30, 1919, and the harvest results are given in Table II. (page 267).

The unmanured produce (plots 1 and 7) averaged 8·6 bushels of corn with 5 cwt. 1 qr. of straw per acre. This was only one-half the yield of the previous year (1917), the unfavourable season entirely accounting for this. The crop was even below the poor one of 1915 (10·1 bushels).

Mineral manures alone gave no increase, but the addition (in 1915) of 1 ton of lime per acre (plot 4b) increased the yield by nearly 4 bushels over the unlimed half, thus repeating the results found in 1915 and 1917. This increase was not apparent when the crop was growing, and it will be noticed that it only came out on weighing the corn and not in the straw.

Sulphate of ammonia without lime gave, as usual, no weighable return, and the small addition of 1 ton per acre of lime (in four dressings of 5 cwt. each) did not prove sufficient (plot 2aa) to overcome the acidity produced by the continuous use of sulphate of ammonia. On the other hand, where 4 tons per acre had been given, the last 2 tons in 1912 (plot 2b), an increase of 6·4 bushels over the unmanured yield was afforded. The addition of mineral manures to sulphate of ammonia with the use of 2 tons of lime per acre as well (plot 5aa) gave 14½ bushels of corn, showing clearly the share that minerals have in checking the effect of acidity. This is brought out well in the corresponding plot (5a) of the continuous wheat series, where complete failure has not yet been reached though no lime has been put on. That, in the case of barley, lime is more needed than for wheat when sulphate of ammonia is employed, is instanced by plot 5b, where, with 4 tons of lime per acre, the yield went up to 17·4 bushels. A higher result still, viz. 22·1 bushels, was obtained by doubling the sulphate of ammonia (plot 8aa).

Nitrate of soda alone, at the rate of 1 cwt. per acre (plot 3a), gave a less yield than no manure, but, at the rate of 2 cwt. per acre, an increase of 10 bushels per acre was obtained. Used with minerals, however, 1 cwt. gave a larger crop (plot 6) than did sulphate of ammonia and lime used similarly with minerals, the produce being still further increased to 27 bushels when the nitrate of soda was doubled (plot 9a).

Rape cake (plot 10b), which had done so well with the wheat, was quite a failure with the barley crop, the increase over no manure being 1½ bushels only. But farmyard manure (plot 11b) gave much the largest crop of the whole series,

reaching 35 bushels, and emphasising how, during the drought of June, this manure had preserved the moisture in the soil in a way that no artificial manure did. Though the general average of the season was so much below that of 1917, the farmyard manure plot gave now 8 bushels more per acre than then.

Lastly, there was little difference between plot 10a and plot 11a, where in the one case potash had been omitted and in the other phosphates, the balance being in favour of the inclusion of potash.

The quality of the corn was so much affected by the unfavourable conditions of reaping that little can be said for it, nor deductions be made from the proportion of tail corn. No sample of the grain was judged to be of even fair quality. The best samples were from plots 2b, 2bb, 5aa, 6, 8aa, 9a and 9b, and these, on a basis of 70*s*. per quarter for the year, might have fetched 68*s*. Because of their dryness and good condition they might have passed for black malt or distilling. The remainder were only fit for grinding and would not have fetched above 65*s*. or 66*s*. per quarter.

ROTATION EXPERIMENTS.—THE UNEXHAUSTED MANURIAL VALUE OF CAKE AND CORN (*STACKYARD FIELD*).

Series C. 1918, *Swedes, after Wheat.*

This crop began what was really a fresh rotation and one in which a change will be introduced. For a number of years past this experiment on rotation has been carried out with the exclusion of a leguminous crop such as clover. The failure of the earliest series of Rotation Experiments on this land to bring out any marked difference between the effect of feeding cake on the land and that of feeding corn, was, rightly or wrongly, attributed to the fact that the intervention of a clover crop (sown in the barley crop) introduced a feature which—by itself supplying nitrogen freely—prevented the difference of manurial value (nitrogen principally) between cake manure and corn manure from telling. In short, the clover supplied so much nitrogen that the higher nitrogen of the cake manure was not required and so could not tell in an increased wheat crop. It has to be remembered that when this experiment was started in 1876 little or nothing was then known of the way in which clover and other leguminous crops enrich the land, for it was not until 1884 that Hellriegel made his discovery of the means by which these crops utilise the atmospheric nitrogen. All practical men knew what a splendid preparation a clover crop was for wheat, but the reason was not known until Hellriegel supplied the explanation. When, however, this was forthcoming it was not difficult to understand why cake-feeding gave no better

return than corn-feeding upon the subsequent wheat crop. There were other features also in the original plan of the experiments which tended to the exclusion of the desired result, e.g., the land was being too highly manured to bring out the required differences, for, not only was the root crop fed off with cake (or corn, as the case might be), but the clover crop too was fed off with cake (or corn). As a consequence, the poorer manuring was quite enough to produce a maximum crop, and, naturally, no differences, or at least no commensurate ones, were shown in favour of the cake-feeding.

The land having been over-manured, as was believed, the next process was one of exhausting it of its supposed over-fertility, and a number of years were spent in getting the soil down to a level of mediocrity and of condition likely to respond to the influence of manuring. After a number of years of crop-growing without manure of any kind, the land was considered to have come down to a fair level and the third series of experiments was started. In these cake- or corn-feeding was given only once in the rotation, viz., when the root crop was fed on, and the amount was not more than the ordinary farmer would give under similar circumstances. This comprises the series just concluded, but the result has again been to show that, on this land at least, the corn-feeding has been just as good as the cake-feeding. This result, in view of the great difference in nitrogen between cake and corn, is, to say the least, difficult to explain, but the repeated obtaining of this result leaves no room to doubt it. The natural conclusion from this experience would be that the theoretical differences between cake and corn, as laid down in Valuation Tables of Unexhausted Manure, are altogether wrong, at least as regards land like that at Woburn. One requires to hesitate, however, before coming to such a drastic conclusion, especially in view of the acknowledged benefit in farm practice generally from the feeding of cake. And, hence, before throwing over the Tables altogether, it behoves one to examine the question more closely and see if there may not be something in the particular conditions under which the experiment has been conducted in the past which will account for the failure. It is, however, quite legitimate to say that this experience at Woburn has been sufficient to cause one to doubt very much whether the Valuation Tables are to be regarded as capable of general application or even as trustworthy as has been believed.

With the view of throwing more light on this very intricate question, the Rotation Experiment in Stackyard Field was readjusted, and once more it is intended to introduce a clover crop into the rotation. In the last series the clover crop was, as stated, rigidly excluded, a green crop (generally mustard)

being substituted for it. But to this it may with reason be said that it is not "practical farming," as no farmer would grow a mustard crop only before wheat and never put in clover, or a mixture of clovers, or "seeds" in which clover of some kind was included. Hence the new series will again include clover. A reference to the first series will show that, with few exceptions, red clover was taken once in four years. This, again, is not what would ordinarily happen in farming, for there would be fear of "clover-sickness." It is intended, therefore, to now proceed more on practical lines, for, after all, what is required is to know what occurs in actual practice. The ingathering of the wheat crop of 1917 on Series C afforded a good fresh starting point, the results of the past few years showing that there was practically little difference between the two plots of this series, nor between the corresponding ones of Series D. adjoining.

Swedes were accordingly sown, and will be followed by barley in which red clover will be sown, and wheat will follow.

After preparation of the land, 3 cwt. per acre of mineral superphosphate were sown on June 4, 1918, and on June 7 swede seed was drilled at the rate of 4 lbs. per acre.

As already described, great difficulties were experienced, through the continued drought of June, in getting a "plant," but, by great care, this was done, and a fairly even, if small, crop was obtained all over the series. This averaged 11 tons per acre and the whole of it was fed on the land by sheep, with corn (barley and oats) on plot 1, and with cake (linseed and cotton) on plot 2. In consequence of the difficulty experienced in getting cake it was not possible to commence the feeding of the roots until February 13, 1919.

Series D.—Rotation Experiment—the Unexhausted Manurial Value of Cake and Corn (Stackyard Field). 1918. *Barley with Red Clover sown in it.*

This series proceeds on the same lines as just described, but, it being decided to grow barley again, this was put in and red clover was sown in it subsequently.

On April 26, 1918, "Chevalier" barley was drilled at the rate of 10 pecks per acre, and on May 22, 1 cwt. per acre of sulphate of ammonia was given as a top-dressing. Red clover was drilled in the barley at the rate of 12 lb. per acre on May 28.

The barley crop was cut on September 13, stacked and subsequently threshed and weighed, the results being given in Table III. (page 273).

The grain was all badly weathered, and there was no practical difference between the "corn" set and the "cake" one.

It was only fit for grinding and would have fetched 64*s*. or 65*s*. a quarter at most, on a basis of 70*s*. for the year.

After the barley crop had been removed, the red clover, owing to the drought, looked only a moderate plant, but it was

TABLE III.—*Rotation Experiment—the Unexhausted Manurial Value of Cake and Corn. Series C* (*Stackyard Field*) 1918—*Barley after Barley.*

Produce per acre.

Plot		Head corn			Tail corn	Straw, chaff, &c.
		Weight	Bush.	Weight per bush.	Weight	
		Lb.		Lb.	Lb.	C. q. lb.
1	Corn-fed Plot	1,101	21·8	50·6	100	12 3 3
2	Cake-fed Plot	934	18·2	51·4	176	13 1 12

"touched up" in October with more seed and, a favourable time intervening, the crop improved greatly and bid fair to "stand" through the winter.

The results of the barley threshing showed only a moderate crop, this not being anything like the produce of the continuous barley series where farmyard manure had been used, nor was it equal to the crop of 1917. A good deal of damage was done to the cake plot through rats, this plot being in close proximity to a German prisoners' camp from which rats swarmed and, getting beyond control, devastated the crops near at hand. It is hard to say, therefore, to what extent the inferiority of the cake-fed plot to the corn-fed one is due to this cause and how far to any difference in the manuring. As the figures stand, the corn-fed plot shows the better by $3\frac{1}{2}$ bushels, though the straw was rather less. In 1917, as also in 1913, a somewhat similar result was observed, and this has led, as already observed, to a change in the plan of future treatment being decided upon.

GREEN-MANURING EXPERIMENTS.

(*a*) *Stackyard Field. Series A.*

Following the green crops of 1918, "Little Joss" wheat was drilled at the rate of 9 pecks per acre on October 27, 1917, and came up well. In spring and early summer the crop after mustard looked the best, then that after rape, while the crop after tares was clearly inferior to the others. Later on, this latter plot grew a quantity of poppies, the difference in this respect between it and the other plots being very marked.

The wheat was cut on August 16, carted on September 24 and stacked. On October 2 it was threshed, the results being set out in Table IV.

TABLE IV.—*Green-Manuring Experiment (Stackyard Field).*

Produce of Wheat per acre, 1918—after Green Crops.

Plot	Manuring in 1916	Head corn			Tail corn	Straw, chaff, &c.		
		Weight	Bush.	Weight per bushel	Weight			
		Lb.		Lb.	Lb.	C.	q.	lb.
2	After tares fed off . . .	690	12·2	56·5	26			
4	After rape fed off . . .	857	15·3	56·0	30	15	2	18
6	After mustard fed off . .	857	15·2	56·25	30	15	3	9

The crop was much damaged by weather, and the "tares" lot suffered much, probably on account of the quantity of poppy weed with it, this causing the recorded weight for straw to be misleading.

It will be seen from the Table that between the mustard and the rape plots there was nothing to choose, and that both were—as the appearances in the field indicated—superior to the tares plot. This result is in accordance with previous experience in this field and also bears out that in Lansome Field, where the crops, instead of being fed on the land, are ploughed in. The wheat crop, however, was distinctly poor, the highest yield being little more than that of the unmanured plot of the adjoining continuous wheat series (14 bushels per acre), and it is clear that the land wants more liberal manuring than it has received by the feeding on of the green crop and the small amount of cake (1½ cwt. per acre) given to the sheep.

As regards quality of grain, the mustard plot was decidedly the best of a poor lot, and, on a basis of 76*s.* per quarter for the year, might have fetched 74*s.*, the rape plot 72*s.*, and the tares 70*s.* only.

(*b*) *Lansome Field.*

Tares—9 pecks per acre—were drilled on April 26, 1918, rape and mustard on May 20. Though the crops came up, the land, under the continuous system pursued of alternate green crop and corn crop without an intervening root crop, had become very foul, and the weeds—horsetail in particular—choked the crops in many places, and quite prevented any uniform growth. Under these circumstances it was decided not to go on with this experiment until the land had received a thorough cleaning. This is to be done in 1919.

GRASS EXPERIMENTS.

1. *Broad Mead*, 1918.

(*a*) Improvement of Old Pasture.
(*b*) Varieties of Lime.
(*c*) Different Forms of Lime.

For a fourth successive year Broad Mead was mown. No further applications of manure or lime were given, but the plots were chain-harrowed in April, 1918, and rolled in May. The grass was mown July 3—8, and the hay carted and weighed July 5—9. The results are given in Tables V., VI., and VII. The crops were heavier than in 1917, but not up to those of 1916.

In the (*a*) series (Table V.) the differences were so slight as to call for no comment, though, as usual, the best aftermath was on plot 3 (basic slag and sulphate of potash).

In (*b*) (Table VI.), again, the crop differences were not

TABLE V.—*Improvement of Old Pasture* (*Broad Mead*).

Produce of Hay per acre, 1918.

Plot	Manuring per acre in 1913	Weight of hay per acre T.	c.	q.	lb.
1	Basic slag 10 cwt. Nitrate of potash 1 cwt.	1	14	1	0
2	Mineral superphosphate 5 cwt. Sulphate of potash 1 cwt.	1	12	2	0
3	Basic slag 10 cwt. Sulphate of potash 1 cwt.	1	13	3	0
4	No manure	1	12	3	0
5	Lime followed (in 1913) by— Superphosphate 3 cwt. Sulphate of potash 1 cwt.	1	11	2	0
6	Dung 12 tons	1	14	2	6

TABLE VI.—*Varieties of Lime on Grass Land* (*Broad Mead*).

Produce of Hay per acre, 1918.

Plot	Lime applied in 1910 and again in 1916[1]	Weight of hay per acre T.	c.	q.	lb.
1	Buxton lime	1	11	3	0
2	Chalk lime	1	8	2	0
3	Magnesian lime	1	10	1	0
4	No lime	1	13	2	0
5	Lias lime	1	14	0	0
6	Oolite lime	1	13	3	0

[1] Two tons per acre in each case.

marked, the unmanured plot giving practically as much hay as any of the others. Much the same applies to (*c*) (Table VII.),

TABLE VII.—*Different Forms of Lime on Grass Land (Broad Mead).*

Weights of Hay per acre, in 1918.

Plot	Lime applied, 1913[1]	Weight of hay per acre			
		T.	c.	q.	lb.
1	Lump lime	1	10	2	0
2	Ground lime	1	11	1	0
3	Nothing	1	10	0	0
4	Ground limestone	1	13	3	0
5	Ground chalk	1	14	1	0

[1] 20*s.* per acre (independently of carriage, cartage, &c.), was spent on each plot for the lime used.

except that here the unmanured plot gave the lowest yield and ground limestone and ground chalk the highest ones.

The very small differences obtained do not, however, allow of any real conclusions being formed this year in respect of any of the three sets of experiments.

2. CHARITY FARM—WESTBROOK FIELD, 1918.

The only plot to be made into hay this year was plot 1.

On February 13 and 14, 1918, an application of $3\frac{1}{3}$ cwt. per acre of steamed bone flour was given to plots 1 and 2, in order to make up for what was removed in the hay as compared with plot 3, which is never hayed. The plots were all chain-harrowed in April, and in May eighteen yearling bullocks were turned out to feed off plots 2 and 3, receiving, however, no other food.

Plot 1 was mown August 2—5, and the hay carted and weighed August 7—8. The yield was 2 tons 0 cwt. 2 qrs. 14 lb. per acre as carted into the stack.

RAINFALL AT WOBURN EXPERIMENTAL STATION, 1917-18.
(292 ft. above sea level.)

	Total Inches	No. of days with ·01 in. or more recorded		Total Inches	No. of days with ·01 in. or more recorded
1917.			March . .	·59	8
October . .	4·15	20	April . .	3·45	20
November . .	1·10	14	May . .	2·38	10
December . .	·54	14	June . .	·61	11
1918.			July . .	4·01	17
January . .	2·13	16	August .	·77	10
February . .	·88	15	September .	5·96	22
			Total . . .	26·57	177

POT-CULTURE EXPERIMENTS, 1918.

1. *The Hills' Experiments—The Influence of Iron Compounds upon Wheat.*

Previous experiments at Woburn with compounds of iron had been confined to sulphate of iron. It was now decided to extend the work to other compounds, the following being selected :—(*a*) Black or magnetic oxide (Fe_3O_4); (*b*) Ferric oxide (Fe_2O_3); (*c*) Ferrous sulphate ($FeSO_4$); (*d*) Ferric sulphate ($Fe_2(SO_4)_3$); (*e*) Ferrous chloride ($FeCl_2$); (*f*) Ferric chloride ($FeCl_3$); (*g*) Ferrous sulphide (FeS); (*h*) Ferric sulphide, or iron pyrites (FeS_2). Inasmuch as little was known of the behaviour of these compounds, it was decided to work with quantities to contain respectively ·1 per cent. and ·2 per cent. of the metal (Fe) as contained in the soil, after mixing it intimately with the several iron compounds. The pure compounds were employed wherever obtainable, but considerable difficulty was found in getting pure black oxide (Fe_3O_4), and pure ferric sulphide (FeS_2). "Hammer scale" had to be used for the former, and iron pyrites for the latter.

The soil used was that from Road Piece field, this being a heavier and richer soil than that of Stackyard Field usually employed in the pot-culture experiments. Ferric chloride was given in solution, all the other applications being used in the solid state, they, after fine powdering, being mixed intimately with the whole of the soil in the pots, these latter being earthenware ones. The quantities given varied from 1·45 tons (Fe_3O_4) to 7·5 tons ($Fe_2(SO_4)_3$) per acre. The experiments were in duplicate. Twenty seeds of wheat ("Browick") were sown in each pot on December 11, 1917, and the germination was noted. There was nothing exceptional until the heavier amount of ferrous sulphate was come to, when the germination was somewhat retarded. This was also noted with the smaller amount of ferrous chloride, but with the higher quantity of this, and also with both lots of ferric chloride, there was marked injury at starting. With ·2 per cent. of iron as ferrous chloride only 8 plants out of 40 possible ones came up, with ·1 per cent. of iron as ferric chloride 11 only, while no plants at all came with ·2 per cent. Missing plants were replaced by re-sowing, but in the case of ·2 per cent. of iron as ferric chloride still no plants appeared. The crops were thinned out on April 2 to 10 plants per pot. The following general observations were made during growth :—(1) Fe_3O_4 showed in the smaller amount a slight improvement upon the control, and a rather greater one when used in the double quantity. (2) Fe_2O_3 certainly no improvement, and possibly a slight deterioration. (3) and (4) The sulphates—a slight depression at first, and then a deepening

of colour of the leaf. (5) $FeCl_2$ ·1 per cent. at first inferiority, then a marked superiority to the control series, together with deepening of colour of foliage ; ·2 per cent. a marked affecting of the plant and inferiority to control. (6) $FeCl_3$ ·1 per cent. very like ·2 per cent. of $FeCl_2$; ·2 per cent. only one plant came up in each pot, and this produced no corn. (7) and (8) FeS and FeS_2 very like control.

It will be seen from this that the only applications which showed any marked influence were those of Fe_3O_4 ·2 per cent., and of $FeCl_2$ and $FeCl_3$, both with ·1 per cent. and ·2 per cent. respectively.

The plants were photographed on August 1, and Plate 1 shows the appearances presented by the above. The crop was reaped on August 10, and the results are recorded in Table I.

TABLE I.—*Iron Compounds on Wheat*, 1918.

	Corn	Straw
No treatment	100	100
Fe_3O_4 containing ·1 per cent. Fe	109·8	112·5
" " ·2 " "	122·3	126·7
Fe_2O_3 " ·1 " "	83·7	87·5
" " ·2 " "	88·8	88·8
$FeSO_4$ " ·1 " "	86·0	97·8
" " ·2 " "	92·1	118·5
$Fe_2(SO_4)_3$ " ·1 " "	80·5	99·7
" " ·2 " "	97·7	110·9
$FeCl_2$ " ·1 " "	183·7	188·5
" " ·2 " "	42·3	60·8
$FeCl_3$ " ·1 " "	73·9	101·1
" " ·2 " "	—	2·7
FeS " ·1 " "	85·1	91·0
" " ·2 " "	91·6	95·4
FeS_2 " ·1 " "	106·0	109·3
" " ·2 " "	98·1	106·9

The roots of the several lots were subsequently examined, but showed no particular points of interest.

The influences shown were practically confined, as stated, to the magnetic oxide and the two chlorides, the first named giving a small increase, and $FeCl_2$ a very marked one so long as the amount of iron as chloride did not exceed ·1 per cent. When, however, the quantity went above this, or was present as ferric chloride, even in the lower amount, there was a marked diminution in yield, the higher amount as ferric chloride, indeed, destroying the plant altogether. Results similar to these have previously been noted at the Pot-Culture Station in the case of the chlorides of sodium, barium, zinc, and lead. As the amount of chlorine increased, the effect, at first favourable, passed on to actual destruction of the crop.



a b c d e f g

PLATE 1.—The influence of Iron Compounds on Wheat. 1918.

(**a**) untreated; (**b**) ·1 per cent. of Iron as magnetic oxide; (**c**) ·2 per cent. as magnetic oxide; (**d**) ·1 per cent. as Ferrous chloride: (**e**) ·2 per cent. as Ferrous chloride; (**f**) ·1 per cent. as Ferric chloride (**g**) ·2 per cent. as Ferric chloride.

Sulphates proved to be without effect, and the sulphides did not seem to have much influence, though, if anything, a detrimental one.

The general conclusions accordingly are :—

1. That iron compounds, with the exception of the chlorides, show singularly little influence either way upon the wheat crop.

2. That the magnetic oxide (Fe_3O_4) has a slightly stimulating influence.

3. That ferrous chloride ($FeCl_2$) has a markedly beneficial effect when not exceeding ·1 per cent. of iron in the soil, but if beyond this has a markedly harmful influence.

4. That ferric chloride is decidedly toxic, and, if present to ·2 per cent. Fe in the soil, will entirely prevent growth.

II. *Time of Application of Sulphate of Ammonia to Corn Crops.*

The question has often been asked as to which is the best time to apply sulphate of ammonia to corn crops, whether entirely as a top-dressing in spring, or whether partly in autumn at sowing, and the remainder in spring. Of course the nature of the particular soil will exercise an important bearing, and the Rothamsted experiments have shown that on a heavy soil, such as exists there, in a year of not excessive drainage there will be no appreciable loss by giving the sulphate of ammonia in autumn when the wheat is sown. On a light soil, such as that of Woburn, there might, however, be considerable loss, and it is generally agreed that, in the case of readily soluble, quickly-acting nitrogenous salts, like sulphate of ammonia and nitrate of soda, it is better to give them as top-dressings in spring, and this is the practice generally followed. Season, however, will play a not unimportant part, and it has often been suggested that it might be better to give one-half of the application in autumn, and reserve the other half for spring. It was felt desirable to try at the Pot-Culture Station these respective practices on a wheat crop grown in the light sandy soil of Woburn.

The experiments were carried out in duplicate in zinc pots, and the arrangement was as follows :—

Pots.		
1 and	2	Control.
3 ,,	4	Sulphate of ammonia, 1 cwt. per acre, applied at time of sowing wheat
5 ,,	6	,, ,, ,, ,, as top-dressing in spring.
7 ,,	8	,, ,, ½ cwt. applied at time of sowing wheat. ½ cwt. ,, as top-dressing in spring.
9 ,,	10	,, ,, 1½ cwt. ,, at time of sowing wheat.
11 ,,	12	,, ,, ,, as top-dressing in spring.
13 ,,	14	,, ,, ¾ cwt. ,, at time of sowing wheat. ¾ cwt. ,, as top-dressing in spring.

The soil used was that from Road Piece field, and wheat ("Red Standard") was sown in the pots on November 20, 1917, each pot receiving also superphosphate at the rate of 5 cwt. per acre.

The plant came up quite well, and the winter application of sulphate of ammonia clearly showed a benefit. On March 30, 1918, the top-dressings were applied. As the several lots progressed, it was difficult to distinguish between the different modes of application, and this was borne out when the crops came to be cut (August 7, 1918) and subsequently threshed out, the results being as given in Table II.

TABLE II.—*Time of Application of Sulphate of Ammonia.*

Treatment	Corn		Straw	
	Weight	Percentage of untreated	Weight	Percentage of untreated
	Grms.		Grms.	
Untreated	34·7	100	67·4	100
Sulphate of ammonia 1 cwt. per acre at sowing	36·9	106·3	74·2	110·1
" " " " top dressed	36·7	105·8	77·0	114·2
" " ½ " at sowing / ½ " top-dressed	38·3	110·4	79 0	117·2
" " 1½ " at sowing	38·4	110·7	82·8	122·8
" " " " top-dre-sed	38·3	110·4	83·3	123·6
" " ¾ " at sowing / ¾ " top-dressed	40·6	117·0	84·3	125·1

These results show that there was but little to choose between the different modes of application, and that, even on the light soil of Woburn, there did not seem to be any material loss by winter application of sulphate of ammonia. On the whole, the best results were obtained from the division of the dressing between autumn and spring application.

These results apply, of course only to pot-culture cultivation. It had been intended to duplicate them in the field, but, unfortunately, heavy flooding of the field (Warren field) in which the plots were took place in winter, and rendered the experiment abortive.

III. *The relative value of various Phosphatic Materials.*

The following experiment was designed to compare the values of different forms of phosphate of lime, the selected ones being: (*a*) superphosphate, (*b*) basic superphosphate, (*c*) basic slag, (*d*) ground Florida pebble phosphate, (*e*) ground Gafsa phosphate, (*f*) steamed bone flour, while in a seventh

case lime alone was used. The soil employed was that of Stackyard Field, which, as is well known, is very low in lime, containing only ·296 per cent. of total lime reckoned as CaO. Earthenware pots were used, each experiment was in duplicate, and the phosphatic materials were given much as they would be in practice, *i.e.* at the rate, in most cases, of 5 cwt. per acre, and mixed with the top 10 lb. of soil in each pot. Of the superphosphate only 3 cwt. per acre were used, and of the basic superphosphate enough to supply the same phosphate as the 3 cwt. of superphosphate. Nitrogen was added in all cases as nitrate of ammonia, applied in spring. Detailed analysis of the materials used, as also of the experiment itself, are unnecessary for reasons that will be stated presently. Wheat was sown on December 31, 1917. All the crops grew well and were cut on August 8, 1918. The results are given in Table III.

TABLE III.—*Phosphatic Materials on Wheat.*

Treatment	Corn		Straw	
	Weight	Percentage of no phosphate	Weight	Percentage of no phosphate
	Grms.		Grms.	
No phosphate	59·3	100	92·5	100
Superphosphate (32 per cent.) 3 cwt. per acre	59·0	97·2	116·2	122·8
Basic superphosphate (29 per cent.) 3 cwt. per acre	64·3	106·0	105·7	111·7
Basic slag (46 per cent.) 5 cwt. per acre	68·7	113·2	115·6	122·2
Florida phosphate (69 per cent.) 5 cwt. per acre	69·2	114·0	102·1	108·0
Gafsa phosphate (59 per cent.) 5 cwt. per acre	65·5	108·0	97·9	103·5
Carbonate of lime	67·6	111·3	103·2	109·1
Steamed bone flour (64 per cent.) 5 cwt. per acre	68·4	112·7	101·1	106·9

The first thing that will strike one on looking at these figures is the very small differences that exist between the various sets. A closer examination will show further that practically as high a return as any was that from the use of carbonate of lime alone (the amount of lime applied being equivalent to that in the richest phosphate). Indeed, it may at once be said that the experiment, as a test of the relative phosphates, was an absolute failure, the one outstanding fact being that it was the lime contained and not the phosphate that caused any increase. It is well, however, to put out this work as an example and as showing what, I am sure, is often the case in recorded experiments, viz that the result is really

due to some cause other than that set for decision. It shows also how such results have to be considered in relation to the particular soil and the particular conditions under review. In the present instance the results obtained were the outcome of employing a soil poor in lime, and it was the lime rather than the phosphate that exerted the benefit.

IV. *Experiments on a Soil deficient in Potash.*

In the course of my visits to different parts of the country I was taken to see, near Salisbury Plain, some "Down" land which had been ploughed out from pasture at different periods, and which certainly exhibited marked differences as regards the growth of clover, as also of barley, according to the time of its ploughing up. I was informed that land that had been ploughed up thirty years back and been arable land for some years and then left to go down again to grass would, when ploughed up, produce quite good crops of barley and of "seeds" (with clover luxuriant), whereas "Down" land which had never been arable (so far as was known) when ploughed up would produce only inferior crops of barley and, when "seeds" were sown, only rye grass would thrive, clover almost entirely failing.

I went to the place in question to satisfy myself of the facts and found these to be as stated. The "seeds" crop on the newly ploughed land that had never been arable consisted almost entirely of rye grass, while on adjoining land, also newly ploughed but known to have been arable thirty years previously, clover grew luxuriantly along with the rye grass.

I had samples of the soil from the respective lands sent me and, after analysing these, the only point of difference I could suggest as likely to account for what was noticed was in respect of the potash contained, the previously arable land containing more potash than that never previously arable. This led me to experiment in pots with the two soils, adding potash salts to the soil poorer in that constituent.

	Inferior soil Per cent.	Better soil Per cent.
The soils contained respectively: Potash (total) .	·19	·28
„ (assimilable)	·01837	·02028

It struck me as possible also that, in the case of the more fertile soil, there might be present, from the earlier arable cultivation, the organisms necessary for the growth of clover, while these might be absent in the soil not previously arable. So I suggested also the mixing of some of the better soil with the inferior and the introduction into the inferior of inoculating material obtained from nodules of clover roots.

Sulphate of potash at the rate of 3 cwt. per acre was added to the inferior soil, and the "soil-mixing" was done by the addition of 10 per cent. of the better soil with the poorer. Two series were started, one in which red clover alone was the crop, the other being red clover and rye grass together. Two crops were obtained in each case and the joint results are given in Table IV.

TABLE IV.—*Experiment with Potash on "Down" land.*

Total crop (2 cuttings).

	Green weight	Dry weight	Percentage of untreated
A. Red Clover.	Grms.	Grms.	
Inferior soil, untreated	34·1	9·2	100
„ „ inoculated	38·0	9·3	101
„ „ + 10 per cent. better soil	42·2	11·4	124
„ „ + sulphate of potash	57·1	16·0	174
Better soil untreated	72·4	18·9	206
B. Clover and Rye Grass.			
Inferior soil, untreated	27·1	7·8	100
„ „ + sulphate of potash	42·1	11·6	149
Better soil untreated	56·7	14·3	184

It will be seen from these figures that, while the inoculation made practically no difference, the addition of 10 per cent. of the better soil raised the yield to some extent, but a far greater benefit was exercised by the addition of sulphate of potash to the inferior soil. Clover, which would scarcely grow on the latter, was now got to thrive, and this whether sown alone or in conjunction with rye grass. With the inferior soil, when clover and rye grass were sown together, the crop consisted, on the untreated plot, almost entirely of rye grass. But when sulphate of potash was added to it the clover came as well.

I was anxious to follow this up by trying practically the application of potash on the land in question, but this, owing to the difficulty of obtaining potash salts, was not practicable that season. I hope, however, to have it tried later on.

Other experimental work was carried out at the Pot-culture station during the season, and in continuation of work already noted in these reports. These do not call for special notice, being, in the main, confirmatory of the results already recorded. Brief mention may, however, be made of the fact that, in pursuing the inquiry into the use of felspar as a source of potash supply, it was found that neither wheat nor mustard responded (with the soil used) to the application of potash, even

sulphate of potash producing no benefit, and hence it was not likely that felspar would. In the earlier experiments it had been shown that with red clover an effect was produced with felspar in the second year of the application, as also with sulphate of potash. But, in extending the work to the wheat and mustard crops, a like benefit was not, for the reason given, obtained.

Another set of experiments was in continuation of those already recorded as regards the respective influences of caustic lime and carbonate of lime, as also of caustic magnesia and cabonate of magnesia on wheat. The previous observations were confirmed as regards the relative action of these compounds ; the reservation should, however, be made that these must not be taken as lending support to the theory of the existence of a definite ratio between the lime and the magnesia in a soil being a determining factor.

J. Augustus Voelcker.

1 Tudor Street,
London, E.C.

Royal Agricultural Society of England.

(*Established May 9th*, 1838, *as the* ENGLISH AGRICULTURAL SOCIETY, *and incorporated by Royal Charter on March 26th*, 1840).

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Year when first elected on Council	
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1916	GILBEY, Sir WALTER, Bart., *Elsenham Hall, Elsenham* (*Essex*).
1918	GRAY, ROBERT, *Sherborne, Northleach* (*Gloucestershire*).
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A.	Bedfordshire	81	1	J. H. Howard.
	Cheshire	536	3	Hon. J. E. Cross; Capt. W. H. France-Hayhurst; G. Norris Midwood.
	Cornwall	102	1	Brooking Trant.
	Derbyshire	176	1	J. T. C. Eadie.
	Dorset	97	1	A. Hiscock.
	Hampshire and Channel Islands	354	2	J. Falconer; Capt. Percy Seward.
	Hertfordshire	216	1	Richardson Carr.
	Lancashire and Isle of Man	497	3	W. Fitzherbert-Brockholes; W. Harrison; Sir John O. S. Thursby.
	Middlesex	101	1	A. W Perkin
	Monmouthshire	90	1	Col. Edward Curre.
	Norfolk	480	2	Davis Brown; Henry Overman.
	Northamptonshire	202	1	Sir C. V. Knightley.
	Northumberland	257	1	G. G. Rea.
	Staffordshire	307	2	John Myatt; R. G. Patterson.
	Worcestershire	208	1	Col. E. V. V. Wheeler.
	Yorkshire, N.R.	176	1	Major Clive Behrens.
	Scotland	223	1	T. A. Buttar.
		—4,103	—24	
B.	Buckinghamshire	169	1	Capt. J. Bell White, R.N.R.
	Devon	195	1	Andrew Rogers.
	Durham	150	1	C. Middleton.
	Essex	221	1	Sir Walter Gilbey.
	Herefordshire	152	1	A. P. Turner.
	Leicestershire	174	1	Sir A. G. Hazlerigg.
	London	512	3	W. W. Chapman; Sir Howard Frank; F. Hamlyn Price.
	Nottinghamshire	206	1	Earl Manvers.
	Rutland	22	1	Lord Ranksborough.
	Shropshire	393	2	Lord Harlech; Alfred Mansell.
	Suffolk	215	1	Fred Smith.
	Surrey	232	1	Major Dunbar Kelly.
	Wiltshire	195	1	James E. Rawlence.
	Yorkshire, W.R.	359	2	Major G. R. Lane-Fox, M.P. C. Howard Taylor.
	South Wales	141	1	Col. C. Venables Llewelyn.
		—3,337	—19	
C.	Berkshire	192	1	W. A. Mount, M.P.
	Cambridgeshire	220	1	J. L. Luddington.
	Cumberland	130	1	Joseph Harris.
	Glamorgan	110	1	D. T. Alexander.
	Gloucestershire	325	2	H. D. Brocklehurst; R. Gray.
	Huntingdonshire	47	1	John Rowell.
	Kent	371	2	T. L. Aveling; H. F. Plumptre.
	Lincolnshire	349	2	John Evens; C. W. Tindall.
	Oxfordshire	175	1	R. W. Hobbs.
	Somerset	184	1	Lord Strachie.
	Sussex	323	2	U. Roland Burke; W. F. Ingram.
	Warwickshire	227	1	Capt. R. Oliver-Bellasis.
	Westmorland	68	1	Lord Henry Bentinck.
	Yorkshire, E.R.	152	1	Capt. T. L. Wickham-Boynton.
	Ireland	111	1	Right Hon. F. Wrench.
	North Wales	278	1	A. E. Evans.
		—3,262	—20	
Foreign Countries		248		
Members with no Addresses		22		
Grand Totals		10,972	63	

TABLE SHOWING THE NUMBER OF GOVERNORS AND MEMBERS IN EACH YEAR FROM THE ESTABLISHMENT OF THE SOCIETY.

Year ending with Show of	President of the Year	Governors		Members			Total.
		Life	Annual	Life	Annual	Honorary	
1839	3rd Earl Spencer	—	—	—	—	—	1,100
1840	5th Duke of Richmond	86	189	146	2,434	5	2,860
1841	Mr. Philip Pusey	91	219	231	4,047	7	4,595
1842	Mr. Henry Handley	101	211	328	5,194	15	5,849
1843	4th Earl of Hardwicke	94	209	429	6,155	15	6,902
1844	3rd Earl Spencer	95	214	442	6,161	15	6,927
1845	5th Duke of Richmond	94	198	527	5,899	15	6,733
1846	1st Viscount Portman	92	201	554	6,105	19	6,971
1847	6th Earl of Egmont	91	195	607	5,478	20	6,391
1848	2nd Earl of Yarborough	93	186	648	5,387	21	6,335
1849	3rd Earl of Chichester	89	178	582	4,643	20	5,512
1850	4th Marquis of Downshire	90	169	627	4,356	19	5,261
1851	5th Duke of Richmond	91	162	674	4,175	19	5,121
1852	2nd Earl of Ducie	93	156	711	4,002	19	4,981
1853	2nd Lord Ashburton	90	147	739	3,928	19	4,923
1854	Mr. Philip Pusey	88	146	771	4,152	20	5,177
1855	Mr. William Miles, M.P.	89	141	795	3,838	19	4,882
1856	1st Viscount Portman	85	139	839	3,896	20	4,979
1857	Viscount Ossington	83	137	896	3,933	19	5,068
1858	6th Lord Berners	81	133	904	4,010	18	5,146
1859	7th Duke of Marlborough	78	130	927	4,008	18	5,161
1860	5th Lord Walsingham	72	119	927	4,047	18	5,183
1861	3rd Earl of Powis	84	90	1,113	3,328	18	4,633
1862	H.R.H. The Prince Consort / 1st Viscount Portman	83	97	1,151	3,475	17	4,823
1863	Viscount Eversley	80	88	1,263	3,735	17	5,183
1864	2nd Lord Feversham	78	45	1,343	4,013	17	5,496
1865	Sir E. C. Kerrison, Bart., M.P.	79	81	1,386	4,190	16	5,752
1866	1st Lord Tredegar	79	84	1,395	4,049	15	5,622
1867	Mr. H. S. Thompson	77	82	1,388	3,903	15	5,465
1868	6th Duke of Richmond	75	74	1,409	3,888	15	5,461
1869	H.R.H. The Prince of Wales, K.G.	75	73	1,417	3,864	17	5,446
1870	7th Duke of Devonshire	74	74	1,511	3,764	15	5,436
1871	6th Lord Vernon	72	74	1,589	3,896	17	5,648
1872	Sir W. W. Wynn, Bart., M.P.	71	73	1,655	3,953	14	5,768
1873	Earl Cathcart	74	62	1,832	3,936	12	5,916
1874	Mr. Edward Holland	76	58	1,944	3,756	12	5,846
1875	Viscount Bridport	79	79	2,058	3,918	11	6,145
1876	2nd Lord Chesham	83	78	2,164	4,013	11	6,349
1877	Lord Skelmersdale	81	76	2,239	4,073	17	6,486
1878	Col. Kingscote, C.B., M.P.	81	72	2,328	4,130	26	6,637
1879	H.R.H. The Prince of Wales, K.G.	81	72	2,453	4,700	26	7,332
1880	9th Duke of Bedford	83	70	2,673	5,083	20	7,929
1881	Mr. William Wells	85	69	2,765	5,041	19	7,979
1882	Mr. John Dent Dent	82	71	2,849	5,059	19	8,080
1883	6th Duke of Richmond and Gordon	78	71	2,979	4,952	19	8,099
1884	Sir Brandreth Gibbs	72	72	3,203	5,408	21	8,776
1885	Sir M. Lopes, Bart., M.P.	71	69	3,356	5,619	20	9,135
1886	H.R.H. The Prince of Wales, K.G.	70	61	3,414	5,569	20	9,134
1887	Lord Egerton of Tatton	71	64	3,440	5,387	20	8,982
1888	Sir M. W. Ridley, Bart., M.P.	66	56	3,521	5,225	16	8,884
1889	HER MAJESTY QUEEN VICTORIA	73	58	3,567	7,153	15	10,866
1890	Lord Moreton	122	58	3,846	6,941	17	10,984
1891	2nd Earl of Ravensworth	117	60	3,811	6,921	19	10,928
1892	1st Earl of Feversham	111	69	3,784	7,066	20	11,050
1893	1st Duke of Westminster, K.G.	107	74	3,786	7,138	21	11,126
1894	8th Duke of Devonshire, K.G.	113	73	3,798	7,212	22	11,218
1895	Sir J. H. Thorold, Bart.	120	80	3,747	7,179	23	11,149
1896	Sir Walter Gilbey, Bart.	126	83	3,695	7,253	23	11,180
1897	H.R.H. The Duke of York, K.G.	126	83	3,705	7,285	24	11,223
1898	5th Earl Spencer, K.G.	121	79	3,687	7,182	25	11,094
1899	Earl of Coventry	116	75	3,656	7,009	23	10,879
1900	H.R.H. The Prince of Wales, K.G.	111	71	3,628	6,832	24	10,666
1901	3rd Earl Cawdor	102	70	3,564	6,338	27	10,033
1902	H.R.H. Prince Christian, K.G.	100	69	3,500	5,955	26	9,650
1903	H.R.H. The Prince of Wales, K.G.	99	62	3,439	5,771	27	9,398
1904	16th Earl of Derby, K.G.	96	68	3,375	5,906	32	9,477
1905	Lord Middleton	89	78	3,212	5,758	33	9,170
1906	Mr. F. S. W. Cornwallis	94	155	3,132	6,189	30	9,600
1907	Earl of Yarborough	91	174	3,076	6,299	29	9,669
1908	Duke of Devonshire	89	178	3,019	6,442	30	9,758
1909	7th Earl of Jersey, G.C.B.	91	177	2,951	6,696	31	9,946
1910	Sir Gilbert Greenall, Bart.	86	166	2,878	6,934	31	10,095
1911	HIS MAJESTY KING GEORGE V.	85	168	2,805	7,191	30	10,279
1912	Lord Middleton	85	170	2,741	7,283	30	10,309
1913	Earl of Northbrook	89	168	2,691	7,474	26	10,448
1914	Earl of Powis	89	173	2,626	7,629	28	10,545
1915	Duke of Portland, K.G.	88	184	2,517	7,313	28	10,130
1916	7th Duke of Richmond and Gordon, K.G.	83	185	2,427	7,526	27	10,248
1917	Mr. Charles Adeane, C.B.	93	210	2,412	8,214	26	10,955
1918	Hon. Cecil T. Parker	102	224	2,395	8,226	25	10,972

STATEMENT made to the Council by the Chairman of the Finance Committee, on presenting the Accounts for the year 1918.

Mr. ADEANE, in presenting, on behalf of the Finance Committee, the Accounts of the Society for the year 1918, said that the total income for 1918 was 11,712*l.*, the expenditure 11,081*l.*, showing a credit balance for the year on the ordinary account of 631*l.* There had been a net increase of expenditure as compared with the previous year of 1,222*l.*, which was almost entirely due to printing. During the year the Society had paid for the cost of cataloguing the Library (537*l.*), for printing the text books (400*l.*), farm account books (174*l.*), and for the increased cost of the Journal (293*l.*). Some of these expenses came under the head of extraordinary expenditure, and would not recur. Others, such as the printing of farm account and text books, were remunerative. The popularity of these books was increasing, and they were soon sold out.

On the income side there was an increase of 1,034*l.* The increase of subscriptions alone amounted to 816*l.*, showing that there had been a great rally to the Society during the war. In the balance-sheet, the only item worthy of remark was that the Society's capital, after writing off depreciation, now stood at 61,047*l.*, against 58,393*l.* at the end of 1917—an increase of 2,654*l.* In 1906 it stood at 7,045*l.*

The Society was to be congratulated on the way in which it had come through the anxious period of the war. In spite of the fact that for two years no shows had been held its credit never stood higher, and the actual value of the Reserve Fund now stood at 51,448*l.*, as compared with 45,032*l.* when the war broke out. The position was really a great deal better, because a sum of 3,462*l.* had been advanced in respect of the Cardiff Show, which would be returned to the general account after the Show has been held this year. Mr. ADEANE mentioned that the income from the society's investments before the war, when income tax stood at 1*s.* 3*d.*, was 1,567*l.* The present income from investments, with the tax at 6*s.* in the pound, was 1,870*l.* He added that the membership at the end of 1918 was 10,972, as compared with 10,545 in 1914.

Mr. ADEANE then presented the estimates for the present year :—

Forecast of Ordinary Receipts and Expenditure for 1919.

(Other than in respect of the Show.)

Prepared by direction of the Finance Committee on the basis of the Recommendations of September 21, 1905, made by the Special Committee.

Actual Figures for 1918.		
£	*Receipts.*	£
9,327	From Subscriptions for 1919 of Governors and Members	9,330
67	From Interest on Daily Balances	100
1,849	From Interest on Investments	1,870
469	From Sales of Text Books, Pamphlets, &c.	2,175
	(This does not include the sales of Journals which are deducted from the cost of production.)	
11,712		13,475

	Expenditure.	
£		£
1,610	Salary of Secretary and Official Staff	1,770
140	Pensions to Officials	140
847	Rent, Lighting, Cleaning, Wages, &c. (say)	850
624	Printing and Stationery	700
206	Postage and Telegrams	220
200	Miscellaneous	250
1,000	Journal	1,000
715	Chemical Department	715
150	Contribution to Woburn Farm	150
131	Contribution to Hills' Bequest	130
250	Botanical Department	250
200	Zoological Department	200
403	Veterinary Department	400
100	Grant to Research Institute, University College, Reading	100
53	Consulting Engineer	52
180	Examinations for National Diploma (R.A.S.E. Share)	220
2,500	Amount set aside towards loss on Shows	2,500
9,309		9,647

	Exceptional Expenditure.	
—	Special Grant to Woburn Farm	1,300
400	Reprint of Society's Text Book	1,800
200	War Emergency Committee	200
135	Occasional Notes to Members	140
137	Library—Purchase of Books, &c.	100
—	Honorarium to Society's Consulting Officials	115
400	Library : Printing Catalogue and Purchase and Binding of Books	—
15	Subscription to Mechanical Transport Association	15
115	Income Tax	—
196	Excess Expenditure in Production of Volume 78 of Journal	—
174	Printing Farm Account Books	—
11 081		13,317

		£
	Estimated Receipts	13,475
	Estimated Expenditure	13,317
631	Estimated Receipts over Expenditure	158

Royal Agricultural Society of England.

STATEMENT OF FUNDS HELD BY THE SOCIETY IN TRUST OR WHICH ARE NOT CONSIDERED AVAILABLE FOR GENERAL PURPOSES, DECEMBER 31, 1918.

	£ s. d.	£ s. d.
To Hills' Bequest for Pot-culture Experiments.	9.000 0 0	
Less: Depreciation of Consols at time of conversion	3.582 7 11	
„ Cost of conversion	134 14 7	
	3,717 2 6	
	5.282 17 6	
To Fund provided by Sir Walter Gilbey for Endowment of Lectureship at Cambridge when after a certain date any balance on this account will become the property of the Society	1,166 1 0	
	£1,166 1 0	
To Superannuation and Insurance Fund:—		
Amount set aside in accordance with Declaration of Trust of July 26, 1911	9,171 5 0	
Less: Depreciation of Consols at time of conversion	1,837 18 4	
Cost of conversion	256 3 0	
	2,094 1 4	
	7,077 3 8	
Income Tax payable on War Stock Interest	219 17 11	
Accumulations to December 31, 1918	651 6 4	
	£7,948 7 11	

	£ s. d.	£ s. d.
By 5,560*l.* 17*s.* 8*d.* 5% War Stock (1929-1947) received under the conversion rights for 5,282*l.* 17*s.* 6*d.* 4½ % War Stock		5,282 17 6
(*Value on December* 31, 1918, at 94½=5,255*l.* 0*s.* 9*d.*)		
		5,282 17 6
By 1,140*l.* Metropolitan Water A Stock at cost		998 1 0
(*Value on December* 31, 1918, at 64¼=732*l.* 9*s.* 0*d.*)		
By amount included in the Society's Sundry Creditors' Account:—	£ s. d.	
Fund uninvested	1 19 0	
Accumulated income	166 1 0	
		168 0 0
		£1,166 1 0
By Investments in names of Trustees of Superannuation and Insurance Funds, viz.:—		
7,449*l.* 12*s.* 4*d.* 5% War Stock (1929-1947) received under the conversion rights for 7,077*l.* 3*s.* 8*d.*) 4½ % War Stock		7,077 3 8
(*Value on December* 31, 1918, at 94½=7,039*l.* 17*s.* 9*d.*		
289*l.* 9*s.* 5*d.* West Australian 3½% Stock (1935-1955) at cost		247 19 0
(*Value on December* 31, 1918, at 72¾=210*l.* 11*s.* 10*d.*)		
140*l.* 4*s.* 6*d.* Queensland 3½% Stock (1950-1970) at cost		120 17 11
(*Value on December* 31, 1918, at 69 =96*l.* 15*s.* 1*d.*)		
Cash at Bank		502 7 4
		£7,948 7 11

Examined, audited, and found correct, this 26th day of February, 1919.

THOMAS McROW, *Secretary.*

JONAS M. WEBB,
H. J. GREENWOOD,
} *Auditors on behalf of*

Royal Agricultural Society of England.

SHOW EXPENDITURE FOR 1918.

Receipts.

	£ s. d.
Receipts	Nil
Excess Expenditure over Receipts	1,388 14 0
	£1,388 14 0

Expenditure.

	£ s. d.	£ s. d.
Erection of Showyard :—		
Amount paid to Contractors for depreciation of Plant and loss of hire for the year 1918		1,000 0 0
Hire of Canvas :—		
Amount paid to Contractors for loss of hire		75 0 0
Surveyor:—		
Surveyor's and Assistant Surveyor's Half Salaries		200 0 0
Wages:—		
Clerk of Works		104 0 0
Insurance		9 14 0
		£1,388 14 0
Amount set aside from Ordinary Account against loss on Shows	2,500 0 0	
Less Excess Expenditure over Receipts	1,388 14 0	
	£1,111 6 0	

Examined, audited, and found correct, this 5th day of December, 1918.

THOMAS McROW, *Secretary.*

DELOITTE, PLENDER, GRIFFITHS & Co., *Accountants.*

JONAS M. WEBB,
HUBERT J. GREENWOOD,
NEWELL P. SQUAREY } *Auditors on behalf of the Society.*

Dr. BALANCE SHEET

Corresponding figures for 1917.		£ s. d.	£ s. d.	£ s. d.
£				
	To SUNDRY CREDITORS—			
2,665	Sundry Creditors		3,517 12 9	
240	Subscriptions received in 1918 in advance		61 13 0	
2,905				3,579
	To CAPITAL—			
55,129	As at December 31, 1917		58,392 18 5	
	SHOW FUND—			
2,500	Amount set aside from Ordinary Account	2,500 0 0		
1,202	*Less* Show expenditure for 1918	1,388 14 0		
1,298			1,111 6 0	
1,365	Life Compositions received in 1918		1,110 0 0	
51	Donation towards the Society's Funds		50 0 0	
819	Credit balance on ordinary income and expenditure account		630 18 4	
58,662			61,295 2 9	
	DEPRECIATIONS written off, viz.:—			
21	Fixtures	19 7 1		
76	Furniture	68 7 7		
4	Machinery	3 17 5		
118	Show Plant	105 18 11		
50	Buildings at Woburn	50 0 0		
269			247 11 0	
58,393				61,047 1
£61,298				£64,626 1

THOMAS McROW, *Secretary.*
DELOITTE, PLENDER, GRIFFITHS & CO., *Accountants.*

Corresponding figures for 1917. £		£ s. d.	£ s. d.
	By RESERVE FUND—		
41,943	45,858*l.* 7*s.* 11*d.* 5 per cent. War Stock (1929-1947) (Value on December 31, 1918 @ 94½=43,336*l.* 3*s.* 8*d.*)		43,555 5 3
	500*l.* War Saving Certificates		387 10 0
2,500	2,840*l.* 13*s.* 6*d.* Metropolitan 3 per cent. Consolidated Stock (1941) at 87¾ . . . . . (Value on December 31, 1918, @ 72⅝=2,063*l.* 0*s.* 10*d.*)		2,500 0 0
6,300	6,528*l.* 1*s.* 6*d.* Canadian 4 per cent. Stock (1940-1960) at 96¼ . . . . . (Value on December 31, 1918, @ 85=5,548*l.* 17*s.* 3*d.*)		6,300 0 0
	By LEASE OF 16 BEDFORD SQUARE	1,900 0 0	
1,900	*Less* Amount written off	100 0 0	1,800 0 0
	By FIXTURES—		
	Value at December 31, 1917	258 1 3	
258	*Less* Depreciation at 7½ per cent.	19 7 1	238 14 2
	By FURNITURE—		
	Value at December 31, 1917	683 16 3	
684	*Less* Depreciation at 10 per cent.	68 7 7	615 8 8
1,500	By PICTURES (500*l.*) and BOOKS (1,071*l.* 4*s.* 10*d.*)		1,571 4 10
	By MACHINERY—		
	Value at December 31, 1917	38 14 0	
39	*Less* Depreciation at 10 per cent.	3 17 5	34 16 7
	By SHOW PLANT—		
	Value at December 31, 1917	1,059 9 4	
1,059	*Less* Depreciation at 10 per cent.	105 18 11	953 10 5
	By BUILDINGS FOR POT EXPERIMENTS AT WOBURN—		
	As per Account at December 31, 1917 . . .	100 0 0	
100	*Less* Depreciation	50 0 0	50 0 0
3,444	By EXPENDITURE ON FORTHCOMING SHOW AT CARDIFF (balance carried forward) . . .		3,461 16 2
896	By SUNDRY DEBTORS		999 16 1
	By CASH AT BANKERS AND IN HAND—		
175	Reserve Fund	494 0 0	
354	Ordinary Account	1,624 9 2	
146	In Hand	40 6 2	
675			2,158 15 4
£61,298			£64,626 17 6

Examined, audited, and found correct, this 26th day of February, 1919.

JONAS M. WEBB,
H. J. GREENWOOD,
NEWELL P. SQUAREY, } *Auditors on behalf of the Society*

The Expenditure in this account includes not only cash payments,

Income.

Corresponding figures for 1917.		£ s. d.	£ s. d.
	ANNUAL SUBSCRIPTIONS:—		
1,074	*Governors*: Subscriptions for 1918	1,178 5 0	
72	*Members*: Received in 1917, but belonging to 1918	239 17 0	
7,176	Subscriptions for 1918	7,589 2 6	
93	Subscriptions for 1918 (additional)	114 5 0	
27	Subscriptions for previous years	141 9 0	
	LIFE GOVERNORS AND MEMBERS:—		
69	Annual Contributions	64 1 0	
8,511			9,326 19 6
	MISCELLANEOUS:—		
21	Interest on Daily Balances	66 19 1	
1,890	Income from Investments	1,848 17 0	
19	Sales of Pamphlets, Farm Account Books and Diagrams	64 9 4	
222	Sales of Text Book	390 2 1	
15	Miscellaneous	14 14 0	
2,167			2,385 1 6
	Rent of 12 Hanover Square	247 10 0	
	Less Rent paid	247 10 0	
£10,678			£11,712 1 0

THOMAS McROW, *Secretary.*
DELOITTE, PLENDER, GRIFFITHS & CO., *Accountants.*

but all liabilities in connection with the year's transactions.

Expenditure.

Corresponding figures for 1917. £		£ s. d.	£ s. d.
	GENERAL ADMINISTRATION:—		
1,555	Salaries of Official Staff	1,609 12 6	
140	Pensions to Officials	140 0 0	
60	Legal Charges and Auditors' Fees	59 6 6	
839	Rent, Rates, Taxes, Insurance, and House Expenses	846 17 1	
7	Purchase of Books	1 9 3	
749	Printing and Stationery	624 1 10	
334	Postage and Telegrams	266 2 2	
66	Carriage of Parcels and Travelling Expenses	68 19 3	
75	Advertising and Miscellaneous Office Expenses	70 7 11	
3,825			3,626 16 6
	JOURNAL OF THE SOCIETY, VOL. 79:—		
672	Printing and Binding	771 9 6	
245	Postage, Packing, and Delivery	245 0 0	
235	Editing and Literary Contributions	250 0 0	
50	Illustrations	60 0 0	
1,202		£ s. d. 1,326 9 6	
47	*Less* Sales (Vol. 78 and earlier)	51 9 6	
275	Advertisements (Vol. 79)	275 0 0	
322		326 9 6	
880			1,000 0 0
23	Excess expenditure in production of Vol. 78		196 9 2
—	Printing Text Book		400 5 6
—	Printing Farm Account Books		173 15 0
	LABORATORY:—		
716	Salary and Petty Cash		715 5 1
	OTHER SCIENTIFIC DEPARTMENTS:—		
250	Botanist's Salary	250 0 0	
204	Zoologist's Salary	200 0 0	
53	Consulting Engineer	52 10 0	
400	Grant to Royal Veterinary College	400 0 0	
100	Grant to Research Institute, University College, Reading	100 0 0	
2	Medals for Proficiency in Cattle Pathology	2 18 2	
1,009			1,005 8 2
	NATIONAL DIPLOMA IN AGRICULTURE:—		
142	Honoraria and Expenses of Examiners	130 19 8	
33	Travelling Expenses of Officials	27 14 9	
30	Hotel Expenses of Examiners and Officials	39 17 9	
58	Printing, Stationery, and Postage	24 18 6	
2	Writing Diplomas	1 5 0	
75	Salaries for Assistants	74 10 0	
340		299 5 8	
57	*Less* Entry Fees and Sales of Examination Papers	44 4 3	
283		255 1 5	
142	*Less* Highland and Agricultural Society's Moiety	127 10 9	
141			127 10 8
	NATIONAL DIPLOMA IN DAIRYING:—		
20	Hire of Premises, &c.	15 17 9	
62	Fees to Examiners	50 17 0	
26	Hotel and Travelling Expenses	33 12 3	
15	Printing and Postage	12 18 11	
123		113 5 11	
26	*Less* Entry Fees and Sales of Examination Papers	61 0 9	
97			52 5 2
	EXTRA EXPENDITURE:—		
—	Library:—Printing and Binding of Catalogue	400 0 0	
58	Assistance in preparing Catalogue, &c.	136 13 9	
106	Hills' Bequest:—Contribution for current year	131 6 1	
—	Income Tax: balance on Interest from investments	115 11 3	
208	War Emergency Committee	200 0 0	
150	Contribution towards Woburn Farm	150 0 0	
14	Subscription to Mechanical Transport Association	15 0 0	
142	Occasional Notes to Members	134 16 4	
674			1,283 7 5
2,500	AMOUNT SET ASIDE TOWARDS LOSS ON SHOWS		2,500 0 0
819	CREDIT BALANCE CARRIED TO BALANCE SHEET		630 18 4
£10,678			£11,712 1 0

Examined, audited, and found correct, this 26th day of February, 1919.

JONAS M. WEBB,
H. J. GREENWOOD,
NEWELL P. SQUAREY,
} *Auditors on behalf of the Society.*

[Copies of the full Report of any of the Council Meetings held during the year 1918 may be obtained on application to the Secretary, at 16 Bedford Square, London, W.C.1.]

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

Minutes of the Council.

WEDNESDAY, FEBRUARY 6, 1918.

The Hon. CECIL T. PARKER (President) in the Chair.

Present:—*Trustees.*—Mr. C. Adeane, C.B., Sir J. B. Bowen-Jones Bart., Col. Cornwallis, the Earl of Coventry, Sir Gilbert Greenall, Bart., C.V.O., the Earl of Northbrook.

Vice-Presidents.—Mr. Percy Crutchley, the Right Hon. Sir A. E. Fellowes, K.C.V.O., Mr. Ernest Mathews, the Duke of Portland, K.G., Mr. Frederick Reynard, the Duke of Richmond and Gordon, K.G.

Other Members of the Council.—Capt. Clive Behrens, Mr. Davis Brown, Mr. W. W. Chapman, the Hon. J. E. Cross, Col. Edward Curre, Mr. J. T. C. Eadie, Mr. James Falconer, Sir Walter Gilbey, Bart., Mr. Arthur Hiscock, Mr. R. W. Hobbs, Sir Charles V. Knightley, Bart., Mr. J. L. Luddington, Mr. Alfred Mansell, Earl Manvers, Mr. Christopher Middleton, Mr. G. Norris Midwood, Mr. W. A. Mount, M.P., Mr. John Myatt, Mr. Henry Overman, Mr. F. Hamlyn Price, Mr. G. G. Rea, Mr. Fred Smith, Lt.-Col. E. W. Stanyforth, Sir John O. S. Thursby, Bart., Capt. J. Bell White, R.N.R., and Capt. T. L. Wickham-Boynton.

Governors.—Capt. Sir Beville Stanier, Bart., M.P., and Mr. B. Vernon.

The PRESIDENT said that as that was the first meeting held under his presidency he would take the opportunity of offering to the Council his sincere thanks for having elected him. His great hope was that his year of office might witness the end of the war.

The minutes of the last monthly meeting of the Council, held on December 5, 1917, were taken as read and approved.

Mr. Charles Rigden, of Court Street House, Faversham, and Mr. W. M. G. Singer, of Norman Court, Salisbury, were elected as Governors, and 71 duly nominated candidates were admitted into the Society as Members.

The Hon. JOHN E. CROSS, in moving the adoption of the Report of the Implement Committee, referred to the recommendation of the Committee regarding the Joint Committee of the Mechanical Road Transport Associations, and gave details of the composition and objects of the Joint Committee. The Council had previously had two representatives on the Committee, and it was now desired to increase the number of representatives to three. He proposed that the Society should approve of the constitution of the Joint Committee of Mechanical Road Transport Associations, and that Messrs. Falconer, Luddington and Aveling should be the representatives appointed by them. It would also be necessary to approve of an annual contribution of 5*l.* in respect of each representative, but this, of course, would first come before the Finance Committee.

Mr. FALCONER thought it was absolutely necessary that agricultural interests should be adequately represented on the Joint Committee. There was a large representation of those connected with the lighter forms of mechanical transport, but the representatives of the Society stood for the interests of those having tractors and other agricultural engines.

The resolution was passed and the Report adopted.

The report of the War Emergency Committee was received and adopted after discussion in which Mr. MATHEWS, Mr. MANSELL, Capt. CLIVE BEHRENS, Sir WALTER GILBEY, Capt. BELL WHITE, Mr. MIDDLETON, Mr. VERNON (Governor), and Mr. REA took part.

The SECRETARY read the following letter from the Sociedad Rural Argentina:—

Sociedad Rural Argentina,
Sarmiento 834,
Buenos Aires,
November 17, 1917.

Thos. McRow, Esq., Secretary of the Royal Agricultural Society of England.

DEAR SIR,—Further to my letter of the 10th July ulto. I have great pleasure in communicating that the judges selected by your Society to act at our show this year fulfilled their tasks with great competence and ability, their verdicts being received with great applause.

We have done our best to make their visit to Buenos Aires as pleasant as possible, and trust they have returned home quite satisfied.

My committee desires me to tender you their most sincere thanks for the great service rendered us in the selection of judges, and to express their appreciation for the pains you have taken to appoint such competent persons, especially taking into account the enormous difficulties you have had to overcome at the present time.

I again beg to offer the services of this society should they be required at any time.

I have the honour to remain, yours very truly,
JOAQUIN S. DE ANCHORENA, President.
ALFREDO N. VIVOT, Secretary.

The PRESIDENT suggested that he should reply to the letter conveying the Council's gratification at the appreciation expressed by the Argentine Society of their efforts in securing satisfactory judges for their annual show, and assuring them of the desire of the Society to render at all times any assistance in their power in connection with the agriculture of their country.

WEDNESDAY, MARCH 6, 1918.

The Hon. CECIL T. PARKER (President), in the Chair.

Present:—*Trustees.*—Mr. C. Adeane, C.B., Lord Moreton, the Earl of Northbrook.

Vice-Presidents.—Mr. Percy Crutchley, the Rt. Hon. Sir A. E. Fellowes, K.C.V.O., Mr. R. M. Greaves, Mr. Ernest Mathews, the Earl of Powis.

Other Members of the Council.—Mr. D. T. Alexander, Mr. H. D. Brocklehurst, Mr. Davis Brown, Mr. Richardson Carr, Mr. John Evens, Sir Howard Frank, Mr. R. W. Hobbs, Major G. R. Lane-Fox, M.P., Mr. J. L. Luddington, Mr. Alfred Mansell, Mr. Christopher Middleton, Mr. W. A. Mount, M.P., Capt. R. Oliver-Bellasis, Mr. A. W. Perkin, Mr. H. F. Plumptre, Lord Ranksborough, C.V.O., C.B., Lieut.-Col. E. W. Stanyforth, Lord Strachie, Sir John O. S. Thursby, Bart., Mr. Arthur P. Turner, and Capt. J. Bell White, R.N.R.

Governor.—Mr. B. Vernon.

The minutes of the last meeting of the Council held on February 6, 1918, were taken as read and approved.

Mr. E. Mackintosh, of 53, Bedford Avenue, London, W.C., Mr. W. C. Medcalf, of Water Hall, Chippenham, Cambs., the Hon. Algernon H. Mills, of Mapledurham House, Reading, and Lady Wantage, of Lockinge Park, Wantage, were elected Governors, and 52 duly nominated candidates were admitted into the Society as Members.

The Report of the Finance Committee was received and adopted together with the Accounts for the year 1917, and Estimates of Receipts and Expenditure for the present year, which were explained in detail by Mr. ADEANE, Chairman of the Finance Committee.

Mr. LUDDINGTON, in presenting the Report of the Chemical and Woburn Committee, said the Committee had gone very carefully into the suggestion

made by Mr. Hobbs, but had found it impossible to carry it out at Woburn this year. They had only a supply of hay and roots sufficient for the stock already on the farm. The experiment of feeding stock without any concentrated food was one which nearly all of them would be obliged to conduct this year, and the Committee thought that a good deal of valuable information would be obtained in the course of this practical experience. Woburn was limited in size, and it was not possible to undertake more than a certain amount of experimental work there. It had been suggested that they might appeal to Members to carry out in a practical way certain experiments on a somewhat larger scale and under the guidance of Dr. Voelcker, and it was felt that this would not only be valuable in itself, but would tend to increase very greatly the interest of the Members in the Society.

The Report of the War Emergency Committee was received and adopted after a discussion in which Mr. MANSELL, Major LANE-FOX, and Mr. MIDDLETON took part, and the following letter was read from the Ministry of Food:—

Ministry of Food,
Palace Chambers,
Westminster, London, S.W. 1.
February 22, 1918.

SIR,—I am directed by the Food Controller to refer to your letter of the 6th instant, enclosing resolutions passed by the War Emergency Committee of the Royal Agricultural Society.

With regard to the first resolution. I am to point out that Lord Rhondda has already announced that the present basis of price for cattle and meat will remain unchanged until the end of this year, and to inform you that a statement will be made very shortly as to price up to June, 1919.

The question of regulating the price of store cattle has been the subject of much consideration at the Ministry, and several committees and conferences have been held to consider it, but it has now been decided that it would not be advisable at present to fix the price of store cattle.

The question of the control of the sale of pigs is being reconsidered, and the propaganda work among farmers, which is the subject of the seventh resolution, is also being undertaken.

The price of wool is a matter for the War Office Contracts Department.

The question of the exemption of bull calves of the Ayrshire, Jersey and Guernsey breeds from the operation of the Live Stock (Restriction of Slaughter) Order was discussed fully by the Central Advisory Committee on Live Stock and Meat Supplies and the Joint Orders Committee of the Board of Agriculture and the Ministry of Food, and it was decided that it was not necessary especially to exempt the bull calves of the Channel Islands breeds, since it is within the power of the auctioneer, being a person authorised by the Food Controller, to brand any calf which appears suitable for slaughter in order that it may be killed (vide Clause 2 (b) ii. of the Order).

With regard to the fifth resolution, the scheme worked out by this Department for the distribution of feeding stuff applies to England Scotland and Wales ; the possibility of extending it to Ireland is at present receiving consideration ; the distribution of seed corn is a matter for the Royal Commission on Wheat Supplies.

I am, Sir, your obedient servant,
(Signed) E. M. H. LLOYD.

T. McRow, Esq., Secretary,
Royal Agricultural Society,
16 Bedford Square, W.C.1.

Mr. Mansell and Mr. Tindall were appointed as the Society's representatives to attend a Conference with Lord Rhondda on the subject of the system of sale of meat by dead weight.

The President and Mr. Mathews were appointed to represent the Society at a conference with the Committee on Milk Production and Distribution.

WEDNESDAY, APRIL 3, 1918.

The Hon. CECIL T. PARKER (President), in the Chair.

Present:—*Trustees.*—Mr. C. Adeane, C.B., Sir J. B. Bowen-Jones, Bart., the Earl of Coventry, Sir Gilbert Greenall, Bart., C.V.O., Sir John H. Thorold, Bart.

Vice-Presidents.—The Rt. Hon. Sir A. E. Fellowes, K.C.V.O., Mr. Ernest Mathews.

Other Members of the Council.—Mr. Davis Brown, Mr. W. W. Chapman, Col. Edward Curre, Mr. John Evens, Mr. J. Falconer, Sir Walter Gilbey, Bart., Mr. R. W. Hobbs, Mr. J. L. Luddington, Mr. Alfred Mansell, Capt. R. Oliver-Bellasis, Mr. Henry Overman, Lt.-Col. E. W. Stanyforth, Sir John O. S. Thursby, Bart., and Capt. T. L. Wickham-Boynton.

Governor.—Mr. B. Vernon.

The minutes of the last monthly meeting of the Council held on March 6, 1918, were taken as read and approved.

Mr. L. B. Beauchamp, of Norton Hall, Bath, Miss E. D. Coats, of Brattles Grange, Brenchley, Mr. George Cochrane, of Wetherby Grange, Yorkshire, Mrs. Robert F. Fuller, of Great Chalfield, Melksham, Mr. C. T. Hoare, of Bignell Park, Bicester, and Mrs. Francis Abel Smith, of Cole Orton Hall, Leicester, were elected as Governors, and 78 duly nominated candidates were admitted into the Society as Members.

Mr. LUDDINGTON, in moving the adoption of the Report of the Chemical and Woburn Committee, said that several replies had been received from Members intimating their willingness to co-operate in the proposed extension of the Woburn experiments to farms in various parts of the country. It was hoped that at the next meeting they would have a large number of such letters to consider in arranging the details of the experiments.

The Report of the War Emergency Committee was received and adopted after discussion in which Mr. MANSELL, the Earl of COVENTRY, Mr. FALCONER, and Mr. VERNON took part.

A letter was read from the National Sheep Breeders' Association, stating that a conference of breeders on the subject of the wool prices for the 1918 clip was being arranged for April 8, asking the Society to appoint a representative, and requesting the use of the Society's room for the purpose of the meeting.

On the motion of Mr. MANSELL, seconded by Mr. ADEANE, Mr. Falconer was appointed to attend the conference. The Council would be pleased to allow the Association the use of their room for the meeting.

WEDNESDAY, MAY 1, 1918.

The Hon. CECIL T. PARKER (President) in the Chair.

Present:—*Trustees.*—Mr. C. Adeane, C.B., Sir Gilbert Greenall, Bart., C.V.O., Lord Moreton, the Earl of Northbrook, Sir John H. Thorold, Bart.

Vice-Presidents.—Mr. Percy Crutchley, Mr. Ernest Mathews, the Earl of Powis, Mr. Frederick Reynard, the Earl of Yarborough.

Other Members of the Council.—Mr. D. T. Alexander, Mr. Davis Brown, Mr. Richardson Carr, Mr. John Evens, Mr. James Falconer, Lord Harlech, Mr. R. W. Hobbs, Sir Charles V. Knightley, Bart., Mr. J. L. Luddington, Mr. C. Middleton, Mr. G. Norris Midwood, Mr. Henry Overman, Mr. A. W. Perkin, Mr. H. F. Plumptre, Mr. Fred Smith, Lieut.-Col. E. W. Stanyforth, Lord Strachie, Mr. C. W. Tindall, and Capt. J. Bell White, R.N.R.

The minutes of the last monthly meeting of the Council held on April 3, 1918, were taken as read and approved.

Capt. Andrew Fletcher, of Saltounhall, Pencaitland, Mr. John Hall, of Chaines Hall, Eccleshall, Mr. B. E. Johnson, of Quickswood, Baldock, Mr. C. W. Kellock, of Highfields, Audlem, Mr. W. W. Kellock, of Highfields, Audlem, and Mr. W. E. Whinery, of Leighton Court, Neston, were elected as Governors, and 79 duly nominated candidates were admitted into the Society as Members.

The Report of the Journal and Education Committee was received and adopted. The following resolution had been received from the Council of the National Library of Wales :—"Resolved that the cordial thanks of the Council be conveyed to the Royal Agricultural Society of England for their gift to the library of about 520 volumes of British and foreign agricultural journals and other publications relating to agriculture."

Mr. LUDDINGTON, in moving the adoption of the Report of the Chemical and Woburn Committee, said that in response to applications for information on certain features of experiments carried out at the Pot Culture Station, they had supplied information which no other station was able to furnish. This showed the importance of the work carried on, which in many respects was second to none.

Mr. REYNARD, in moving the adoption of the Report of the Stock Prizes Committee, said that the Sub-Committee had made a selection of gentlemen to be invited to act as judges at the show of the Sociedad Rural Argentina in September next.

The Report of the War Emergency Committee was received and adopted after discussion in which Capt. BELL WHITE, Mr. MIDDLETON, Lord STRACHIE, Mr. MIDWOOD, Mr. FALCONER, Mr. MATHEWS, and Mr. CARR took part.

Capt. BELL WHITE formally moved the following resolution, which was seconded by Mr. ERNEST MATHEWS and carried unanimously :—"That representations be made by this Council to the Director-General of Food Production asking him to open negotiations with the Ministry of Munitions with a view to obtaining the release of some of the firms under Government control who are makers of cheese-making utensils, in order that farmers desiring to make cheese can secure the necessary apparatus."

Lord STRACHIE then moved :—"That the War Emergency Committee be requested to call the attention of the War Office to the unfairness in not allowing a grower to sell hay to a consumer except through the intermediary of a dealer."

This was seconded by Mr. FALCONER and adopted.

Lord NORTHBROOK brought to the notice of the Council a resolution passed by the Shorthorn Society as follows :—"The Council of the Shorthorn Society views with apprehension the rumours as to the commandeering of hay, and urges the Royal Agricultural Society to use its best endeavours to secure that an adequate supply is left to breeders for the use of their own stock." Lord NORTHBROOK said he was not present at the meeting of the Shorthorn Council, but he understood that their resolution was based upon something more than rumours, and upon certain correspondence which had been placed before that Society, which he then read to the Council.

Mr. DAVIS BROWN said he understood that the hay now being dealt with was the surplus of the 1917 crop.

Lieut.-Col. STANYFORTH explained that, at the meeting of the Shorthorn Society Council, it was stated that the intention was that, after August 1, all the hay left from last year's crop would be commandeered by the Government at once. If this was so, it was a very serious thing for breeders of pedigree stock. New hay could not be fed immediately to stock, farmers had had to plough up a considerable amount of grass land, and personally he had grave apprehension as to how he was going to feed his stock if he was not to be allowed to keep the residue of last year's hay. He thought the subject was one which should be referred to the War Emergency Committee to deal with as they thought fit.

On the motion of Mr. ADEANE, seconded by Lieut.-Col. STANYFORTH, it was decided to express the sympathy of the Council with the resolution of the Shorthorn Society, and to refer that resolution to the War Emergency Committee for further consideration.

WEDNESDAY, JUNE 5, 1918.

The Hon. CECIL T. PARKER (President) in the Chair.

Present :—*Trustees.*—Mr. C. Adeane, C.B., Sir J. B. Bowen-Jones, Bart., Col. Cornwallis, the Earl of Coventry, Sir Gilbert Greenall, Bart., C.V.O., Lord Middleton, Lord Moreton, the Earl of Northbrook, Sir John H. Thorold, Bart.

Vice-Presidents.—Mr. Ernest Mathews, the Earl of Powis, Mr. Frederick Reynard, the Duke of Richmond and Gordon, K.G., the Earl of Yarborough.

Other Members of the Council.—Mr. Davis Brown, Mr. T. A. Buttar, Mr. Richardson Carr, Mr. W. W. Chapman, Col. Edward Curre, Mr. J. T. C. Eadie, Mr. John Evens, Mr. W. Fitzherbert-Brockholes, Lord Harlech, Mr. Arthur Hiscock, Mr. R. W. Hobbs, Major Dunbar Kelly, Mr. J. L. Luddington, Mr. Alfred Mansell, Earl Manvers, Mr. C. Middleton, Capt. R. Oliver-Bellasis, Mr. A. W. Perkin, Mr. H. F. Plumptre, Mr. Andrew Rogers, Mr. C. Coltman Rogers, Capt. Percy W. Seward, Lieut.-Col. E. W. Stanyforth, Lord Strachie, Mr. A. P. Turner, Capt. J. Bell White, R.N.R., and Capt. T. L. Wickham-Boynton.

The minutes of the last monthly meeting of the Council held on May 1, 1918, were taken as read and approved.

The PRESIDENT, in opening the proceedings, said :—Since the last meeting of the Council the Society had sustained a loss by the death of the Duke of Northumberland, who had been connected with the Society for several years, and was elected a vice-president in 1908, the year of the Newcastle Show. The Society had been represented at the funeral service at Lesbury by Mr. George G. Rea, and at the memorial service at Westminster Abbey by the Secretary.

The Council would doubtless desire to place on record their sense of the loss which not only the Society but the country at large had sustained by the death of the Duke, whose great landed possessions had been administered by him in the fullest extent to the benefit of the tenants and the community in general.

Col. Sir Mark Sykes, Bart., M.P., of Sledmere, Malton, was elected as a Governor, and 42 duly nominated candidates were admitted into the Society as Members.

Mr. LUDDINGTON, in moving the adoption of the Report of the Chemical and Woburn Committee, said that while the prices of compound cake were controlled those of feeding stuffs were not controlled in any way. This had been demonstrated as the result of an application made to Dr. Voelcker for an analysis of a sample of feeding stuffs for pigs. The Member forwarding the sample had stated that the price demanded was 25*l.* 6*s.* 8*d.* per ton, whereas it was found by Dr. Voelcker that if sold as compound cake the maximum charge should be 17*l.* 7*s.* 6*d.*

Mr. ROGERS, in moving the adoption of the Report of the Botanical and Zoological Committee, said the following resolution had been received from the Royal English Arboricultural Society :

> "The Council are of opinion that, pending the appointment of a permanent forestry authority, the Forestry Sub-Committee of the Reconstruction Committee should be empowered to carry out the recommendations embodied in their final report."

Also that since the meeting of the Committee a complaint had been received from the Manchester Corporation Waterworks relating to a severe attack of caterpillars which would be considered in the usual way by the Committee.

Capt. SEWARD called attention to the danger arising from the sale and consumption of certain classes of feeding stuffs. He knew of a case of a man who, after using a compound feeding stuff, lost three valuable carthorses and had seventeen others, including a stallion visiting the farm, rendered dangerously ill. This particular compound had also been given to pigs with very disastrous results, and the deleterious agency proved to be castor oil bean. This showed how very necessary it was to use every possible care in the employment of feeding stuffs.

The PRESIDENT said that the case referred to clearly indicated the necessity for feeding stuffs to be subjected to analysis before purchase.

Lord NORTHBROOK said the Veterinary Committee had not received reports of disease being caused in this way, but they would certainly inquire into the matter.

The Report of the Stock Prizes Committee was received and adopted together with the following resolution which had been passed by the Committee for consideration of the War Emergency Committee :

> "The Committee are of opinion that the proposed restrictions on the export of pedigree livestock if carried out would be most detrimental to the best interests of the country."

In moving the adoption of the Report of the Dairy and Produce Committee Mr. MATHEWS said that it was exceedingly satisfactory to know that the Committee set up for dealing with wool had at last recognised the principle of the Flock Books. The necessary qualification was that the flocks should be registered and have numbers in the Flock Books. He had received a letter from the chairman of the Wool Committee for his own particular area asking him to give the names of all breeders of Southdowns in the area, and stating that they would be entitled to the full price of the wool of that breed assuming it was of the best quality.

If the War Office could thus recognise the work of the Flock Books, it would be a very good thing, he thought, if the Board of Agriculture would adopt a similar attitude. He hoped that in time it would also be possible for the milk obtained from particular breeds to be dealt with in the same way, so that herds entered in the official Herd Books might receive better treatment.

In regard to the supply of cheese-making apparatus it seemed that there was still some difficulty. Most of the implement-making firms were controlled establishments, and although they might not be prevented directly from making utensils for the manufacture of cheese they were commandeered for other work. He believed, however, that it was now possible, with the application of pressure, to obtain some of the smaller utensils required for cheese-making.

The Report of the War Emergency Committee was received and adopted after discussion in which Mr. PERKIN, Mr. DAVIS BROWN, Mr. LUDDINGTON, Mr. MANSELL, Mr. BUTTAR, Lord NORTHBROOK, and Mr. MIDDLETON took part.

Mr. ADEANE proposed, and Mr. MATHEWS seconded, and it was unanimously resolved, that the following gentlemen should be asked to form a deputation from the Society to wait upon Mr. Prothero upon the subject of the proposed restriction of the export of pedigree live stock :—The President, Sir Gilbert Greenall, Bart., C.V.O., Mr. C. W. Tindall, Mr. F. Reynard, Mr. T. A. Buttar, and Mr. W. W. Chapman.

The SECRETARY reported that the Trustees of the "Queen Victoria Gifts" Fund had decided to make a grant to the Royal Agricultural Benevolent Institution of 140*l.* for the year 1918, to be distributed as fourteen grants of 10*l.* each to the male candidates, married couples, and female candidates who polled the largest number of votes in their class and who would not this year receive grants from any other fund in connection with the Royal Agricultural Benevolent Institution.

WEDNESDAY, JULY 31, 1918.

The Hon. CECIL T. PARKER (President), in the Chair.

Present :—*Trustees.*—Mr. C. Adeane, C.B., Sir J. B. Bowen-Jones, Bart., the Earl of Coventry, Lord Middleton, Lord Moreton, the Earl of Northbrook, Sir John H. Thorold, Bart.

Vice-Presidents.—Mr. Ernest Mathews, Mr. Frederick Reynard.

Other Members of the Council.—Mr. Richardson Carr, Mr. W. W. Chapman, Col. Sir Edward Curre, Mr. John Evens, Mr. James Falconer, Sir Walter Gilbey, Bart., Lord Harleeh, Mr. Joseph Harris, Mr. W. Harrison, Mr. Arthur Hiscock, Mr. R. W. Hobbs, Major G. R. Lane-Fox, M.P., Mr. J. L. Luddington, Mr. Alfred Mansell, Mr. C. Middleton, Mr. Henry Overman, Mr. H. F. Plumptre, Mr. F. Hamlyn Price, Capt. Percy W. Seward, Mr. Fred Smith, Lieut.-Col. E. W. Stanyforth, and Mr. C. W. Tindall.

Governor.—Mr. B. Vernon.

The minutes of the last monthly meeting of the Council held on June 5, 1918, were taken as read and approved.

Mr. Sydney C. Bristowe, of Craig and Barnshalloch, Sir W. E. B. Ffolkes, Bart., of Cougham Lodge, King's Lynn, Major D. W. Graham, of Rosemoor, Torrington, Mr. J. T. Hereford, of Sufton, Sir W. B. H. Hughes-Hunter, Bart., of Plas Coch, Llanfairpwll, and Mr. E. Festus Kelly, of Hollington House, Newbury, were elected Governors, and 48 duly nominated candidates were admitted into the Society as Members.

The Report of the Finance Committee was received and adopted together with the recommendation that the sum of 850*l.* should be transferred from the reserve account to the ordinary account, and that the sum of 1,612*l.* 10*s.* be invested in the 5 per cent. War Stock (1929—1947) and 387*l.* 10*s.* in War Savings Certificates.

Mr. LUDDINGTON, in moving the adoption of the Report of the Chemical and Woburn Committee, called attention to the very satisfactory result of the action taken by Dr. Voelcker to secure compensation for a Member for the loss of his cows.

Sir JOHN THOROLD (in the absence of the Chairman), in moving the adoption of the Report of the Botanical and Zoological Committee, said that in compliance with a request from the War Office (Raw Materials Department) the Secretary and Mr. Warburton had attended a conference on the ox-warble fly, and Mr. Warburton had explained the life-history of the ox-warble fly, and also what had been done by the Society in connection with this pest for many years past. The conference decided to form a committee representative of all the interests, in order to consider the best means to adopt for getting rid of the ox-warble pest.

In moving the adoption of the Report of the Stock Prizes Committee Mr. REYNARD said there had been great difficulty this year in making the selection of judges for the Palermo Show owing to the position of farmers on account of the scarcity of labour and from other causes. He thought, however, they might assure the Sociedad Rural Argentina that when the war was over many of the best British breeders and judges would be pleased to have the honour of acting as judges at the show. It was with regret that he had to report that they had failed to secure judges in the cases of Aberdeen-Angus cattle, Lincoln sheep, and pigs.

Mr. MATHEWS said that since the last meeting he had received a letter from Mr. Payne, of the Wool Purchasing Committee, stating that he had been pleased to find that the Southdown wools from the districts other than Sussex were as good as those from Sussex itself, and that where the quality was the same the same price would be paid.

The PRESIDENT reported that at the last meeting of the Council a deputation was appointed to wait on the Minister of Agriculture with reference to the proposed restriction on the export of live stock.

He regretted that he had been unable to attend the deputation, which was introduced by Sir Gilbert Greenall, and the views of the Council were explained by several of the representatives. Mr. Prothero gave the speakers a very sympathetic hearing and subsequently the following letter was received by Sir Gilbert Greenall from the Board of Agriculture :—

SIR, I am directed by the President of the Board of Agriculture and Fisheries to refer to the representations made to him by the members of the deputation

which you introduced on the 5th inst., on the subject of the export of pedigree stock, and I am to say for your and their information that it has been decided to deal with applications for export on their merits without regard to average exports during the last three years or by an individual or to a particular country.

Exporters have been notified accordingly by the War Trade Department, and a notice of the alteration of procedure was inserted in the *Times* of the 12th inst.

Mr. Prothero thinks, however, that some members of the deputation may wish to be informed of this decision, and perhaps you will be good enough therefore to notify them accordingly either directly or through the Secretary of the Royal Agricultural Society of England.

I am, Sir,
Your obedient Servant,
(Signed) E. B. SHINE
(for Secretary).

Sir Gilbert Greenall, Bart., C.V.O.

Sir JOHN THOROLD formally moved that the Council should elect Mr. C. Coltman Rogers as a Vice-President of the Society. They were all aware of the excellent work Mr. Rogers had for many years done in connection with the Forestry Department, and it would be a very fitting recognition of his efforts if they appointed him to this position. The resolution was seconded by Mr. ADEANE and carried unanimously.

On the motion of Sir JOHN THOROLD the Report of the Selection Committee was adopted, the PRESIDENT remarking that the recommendation that the facilities of the Society should be extended to the Overseas troops was the least the Society could do for them.

The PRESIDENT informed the Council that a letter, dated July 11, had been received from the Secretary of the Board of Agriculture asking the Council to appoint two further Members on the new Central Advisory Council, and also asking that the representatives should be Professor Somerville and Mr. S. W. Farmer, two members of Mr. Prothero's Advisory Committee, to which the Secretary had replied that the matter would be considered by the Council at their next meeting.

An announcement had appeared in the *Times* on the 12th instant that these two gentlemen had been appointed to represent the Society, and on seeing this he (the President) sent a letter to the *Times*, which most of them had seen, and to this he received a reply from Sir A. D. Hall, on the 23rd instant, expressing regret that the Society should have been placed in a false position by the publication of the names of the two gentlemen as the nominees of the Society.

The PRESIDENT added that the matter had been dealt with by the War Emergency Committee at their meeting held on the previous day.

The Report of the War Emergency Committee was adopted after discussion in which Mr. HOBBS, Mr. MANSELL, Mr. EVENS, Lord MIDDLETON and Mr. FRED SMITH took part.

The SECRETARY reported that a letter had been received from the Royal Agricultural Benevolent Institution with reference to a great paucity of male and married candidates for the Institution, but no decrease in the number of females. It was suggested that the Society should make grants to the Institution as follows :—

> Two gifts of 10*l.* each in respect of male candidates ; four gifts of 10*l.* each in respect of married couples ; and eight gifts of 10*l.* each in respect of female candidates.

On the motion of Mr. ADEANE the suggestion was approved.

Mr. VERNON asked whether anything was being done by the Society with regard to the prices for beef cattle during the winter months.

The Earl of COVENTRY said he was anxious to know exactly when the increased prices became operative. Personally, he thought the rise should commence on October 1, and this would give the farmers the opportunity of following the old practice of putting cattle into the yard in the autumn. He was sorry to say that that practice had been to some extent given up during the last few years, and that would lead to results detrimental to the farms.

Mr. ADEANE said that the present price of 75*s.* per cwt. remained in force until December, when it was increased to 76*s.* For January the price was 78*s.*,

for February 79*s*., for March, April, May and June 80*s*, and it declined to 75*s*. again in July, 1919.

Mr. VERNON asked whether the Food Controller imagined he was going to get the beef at 80*s*.

Mr. MANSELL pointed out that over and above the prices quoted 1*s*. per cwt. was allowed if a beast was of specially good quality. Last year farmers were selling at 75*s*. in October, and were told by the Food Controller to keep their beasts and sell them at 60*s*. in January. Happily, this year the scale was on the up grade. As a member of the Advisory Committee he would say that it must be remembered that in all arrangements as to prices the Consumers' Council had to be consulted and their sanction obtained.

WEDNESDAY, NOVEMBER 6, 1918.

The Hon. CECIL T. PARKER (President), in the Chair.

Present :—*Trustees.*—Mr. C. Adeane, C.B., Sir J. B. Bowen-Jones, Bart., the Earl of Coventry, Sir Gilbert Greenall, Bart., C.V.O., Sir John H. Thorold, Bart.

Vice-Presidents.—Mr. Percy Crutchley, the Right Hon. Sir Ailwyn E. Fellowes, K.C.V.O., Mr. Ernest Mathews, Mr. Frederick Reynard.

Other Members of the Council.—Mr. D. T. Alexander, Major Clive Behrens, Mr. Davis Brown, Mr. Richardson Carr, Mr. John T. C. Eadie, Mr. John Evens, Mr. James Falconer, Sir Walter Gilbey, Bart., Mr. R. W. Hobbs, Mr. John Howard Howard, Mr. W. F. Ingram, Mr. J. L. Luddington, Mr. Alfred Mansell, Mr. C. Middleton, Mr. G. Norris Midwood, Mr. Henry Overman, Mr. H. F. Plumptre, Mr. F. Hamlyn Price, Mr. G. G. Rea, Capt. Percy W. Seward, Mr. Fred Smith, Lieut.-Col. E. W. Stanyforth, Lord Strachie, Capt. J. Bell White, R.N.R., and Capt. T. L. Wickham-Boynton.

Governor.—Mr. B. Vernon.

The PRESIDENT, before formally opening the proceedings, said : "It is my painful duty to officially inform the Council of the loss by death since the last meeting of Mr. J. Marshall Dugdale, who had been associated with the Society since the year 1888, when he was elected a Member. In 1891 he was elected a member of the Council, and in 1905 he was appointed a Vice-President.

"Mr. Dugdale had acted as Steward of Dairying from 1895 to 1898, and had been Chairman of the Dairy Committee from 1899 to 1905 ; he had also been Chairman of the National Agricultural Education Board, in the work of which he had always taken the liveliest interest.

"Many Members will remember the enthusiastic manner in which Mr. Dugdale assisted in the Society's operations in various sections of its work, and I feel sure it will be the wish of the Council that I should convey the expression of their sincere regret at the loss of their colleague, and their condolences with Mrs. Dugdale and the members of her family."

The proposition was carried in silence. The Members signified their assent by rising in their places.

The minutes of the last monthly meeting of the Council held on July 31, 1918, were taken as read and approved.

Mr. Colin F. Campbell, of 9-13, King William Street, London, E.C., Lady Fitz-Gerald, of Buckland, Faringdon, Major Norman McLeod, of Thornes Barton, Berkhamsted, Mr. Harry Mallaby-Deeley, M.P., of Mitcham Court, Surrey, Mr. Charles Coltman Rogers, of Stanage Park, Brampton Brian, Mr. E. S. Shrapnell-Smith, of Hound House, Shere, Surrey, Mr. Charles B. C. Storey, of Plas Nantry, Glyn, Chirk, Major E. W. Tate, of Pool Park, Ruthin, and Lord Tollemache, of Peckforton Castle, Tarporley, were elected as Governors, and 100 duly nominated candidates were admitted into the Society as Members.

Mr. LUDDINGTON, in moving the adoption of the Report of the Chemical and Woburn Committee, called attention to the cases mentioned by Dr. Voelcker showing how unsatisfactory the regulations were regarding feeding stuffs. The matter had been strongly brought to the notice of the departments, and the Committee were given to understand that some measures would be adopted to remedy the state of things now existing.

Col. STANYFORTH, in moving the adoption of the Report of the Veterinary Committee, drew attention to the recent outbreaks of foot and mouth disease in this country and to the cases of rabies, which had assumed a serious aspect in Devon and Cornwall.

Sir JOHN THOROLD, in accordance with the recommendations of the Committee, formally moved that Col. Stanyforth should be appointed a Vice-President in the place of the late Mr. J. Marshall Dugdale. Col. Stanyforth had given long service, and would, he was sure, make a most efficient Vice-President.

The motion was seconded by Mr. ADEANE and carried unanimously.

Col. STANYFORTH said he was extremely grateful to the Council for the honour they had done him in electing him a Vice-President. It was most gratifying that his twenty-seven years of humble service should be marked in this manner. Although it was twenty-seven years since he was elected on the Council, he began his work for the Society six or seven years before that as assistant steward at the Shrewsbury Show of 1884. It had always been a great labour of love to act upon the Council, where, month by month, he had met what he called the brains of agriculture. Apart from the educational aspect of that experience, he had made many friends, a good many of whom, he was sorry to say, were now dead, but who had been replaced by others whom it had been a delight and pleasure to meet. He assured the Council that his services would be always at their disposal.

Sir JOHN THOROLD then moved the adoption of the Report of the Selection Committee, and said that the reason for the proposal to adjourn the annual meeting until February was that the immediate conditions were somewhat uncertain, but it was thought that by February they might be in a position to bring forward definite propositions.

Mr. LUDDINGTON called attention, in connection with the appointment of representatives on the Conjoint Board of Scientific Societies, to the fact that a draft report had been issued by that Board dealing with the metric system, and suggesting various alterations for the simplification of the British system. He thought that if any sweeping change was to be recommended the opinion of the Council should be obtained, and that it should not be left to their representatives on the Board to offer comments or criticism.

Sir JOHN THOROLD said that the report to which Mr. Luddington referred was rather a non-committal document, and he gathered that it was somewhat adverse to the decimal system.

On the suggestion of Mr. ADEANE it was agreed that if further copies of the report were available they should be circulated to the members of the Council.

The Report of the War Emergency Committee was adopted after discussion in which the Hon. CECIL PARKER, Mr. OVERMAN, Mr. MIDDLETON, Mr. MANSELL, Mr. VERNON, Col. STANYFORTH, Mr. REA, and Mr. INGRAM took part.

The following letter from the Shorthorn Society was read, and was referred to the War Emergency Committee for consideration :—

12, Hanover Square, London, W. 1.
November 5, 1918.

DEAR SIR,—At the meeting of the Council of this Society to-day the following resolution was passed, and I was directed to send copies to the President of the Board of Agriculture, the Royal Agricultural and the Breed Societies, with the expression of the hope that the Societies would support the resolution and forward same to the Minister of Agriculture :—

"The Council of the Shorthorn Society deprecate the further ploughing up of any grass lands, as the decrease of grazing and meadow land throughout the

country is causing serious depletion in the cattle stocks, and is also threatening the supply of milk."

I am, Dear Sir, yours truly,
E. J. POWELL, Secretary.

Thomas McRow, Esq., Secretary,
Royal Agricultural Society of England,
16 Bedford Square, W.C. 1.

The Report of the Council to the Annual General Meeting of Governors and Members, to be held at the Society's house, 16 Bedford Square, London, W.C., at 12 noon, on Wednesday, December 11, had been prepared and was ordered to be issued.

WEDNESDAY, DECEMBER 11, 1918.

The Hon. CECIL T. PARKER (President) in the Chair.

Present:—*Trustees.*—Sir J. B. Bowen-Jones, Bart., the Earl of Coventry, Sir Gilbert Greenall, Bart., C.V.O., Lord Middleton, Sir John H. Thorold, Bart.

Vice-Presidents.—The Right Hon. Sir Ailwyn E. Fellowes, K.C.V.O., Mr. Ernest Mathews, Mr. Frederick Reynard, Mr. C. Coltman Rogers, Lieut.-Col. E. W. Stanyforth.

Other Members of the Council.—Mr. D. T. Alexander, Mr. H. Dent Brocklehurst, Mr. Davis Brown, Mr. U. Roland Burke, Mr. T. A. Buttar, Mr. W. W. Chapman, the Hon. J. E. Cross, Mr. John Evens, Mr. James Falconer, Sir Howard Frank, K.C.B., Sir Walter Gilbey, Bart., Mr. Robert Gray, Lord Harlech, Mr. Joseph Harris, Sir Arthur G. Hazlerigg, Bart., Mr. A. Hiscock, Mr. R. W. Hobbs, Mr. W. F. Ingram, Sir Charles V. Knightley, Bart., Mr. J. L. Luddington, Mr. Alfred Mansell, Earl Manvers, Mr. W. A. Mount, M.P., Mr. John Myatt, Capt. R. Oliver-Bellasis, Mr. Henry Overman, Mr. H. F. Plumptre, Mr. F. Hamlyn Price, Mr. A. Rogers, Mr. Fred Smith, Mr. Brooking Trant, Mr. A. P. Turner, Col. E. Vincent V. Wheeler, Capt. J. Bell White, R.N.R., and Capt. T. L. Wickham-Boynton.

The following members of the Cardiff Local Committee were also present: Sir J. W. Courtis, Mr. Edward Akers, Mr. Hubert Alexander, Mr. E. W. M. Corbett, Mr. Wm. Emerson, and Alderman Illtyd Thomas.

Before proceeding to the ordinary business, the PRESIDENT referred to a most important event which had occurred since the last meeting, viz., the signing of the Armistice, and said he was sure the Council would wish to present an address of congratulation to His Majesty the King. He moved that the following address be forwarded to the Secretary of State for Home Affairs, for humble submission to His Majesty:—

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

To the King's Most Excellent Majesty.

May it please Your Majesty:

We, the President and Council representing the general body of Governors and Members of the Royal Agricultural Society of England, desire humbly to approach Your Majesty with the assurance of our loyal and devoted attachment to Your Majesty's Throne and Person, and to present our sincere and respectful congratulations to Your Majesty on the signing of the Armistice which was appealed for by the Enemies of Your Majesty's Empire.

We, in common with all classes of the community, feel deeply grateful that victory has been assured by the valour of Your Majesty's Naval, Military and Air Forces, and the Armies of Your Majesty's Allies, all of whom have triumphantly vindicated the principles of justice and freedom upon which the Empire is founded.

We beg to assure Your Majesty that the Agriculturists of England are devotedly attached to Your Throne and Person, and on their behalf we earnestly pray that the Almighty may vouchsafe to Your Majesty health and strength for many years to reign over a happy, united and prosperous people.

Given under the Common Seal of the Royal Agricultural Society of England this eleventh day of December, 1918.

Signed { CECIL T. PARKER, President.
COVENTRY, Trustee.
THOS. MCROW, Secretary.

The President's motion was carried with acclamation, and the Common Seal of the Society was affixed to the address.

The PRESIDENT said it was with much regret that he had to announce the death of one of the oldest and best known Members of the Council, Col. Christopher Wilson, which occurred at Rigmaden Park on the 8th inst., at the age of seventy-four.

Col. Wilson had been connected with the Society for a great number of years, having been elected a Member in the year 1867, and having been a Member of Council for nearly thirty years, his election taking place in the month of May, 1889.

He had been a very active member of various committees, and both as a judge and steward in the showyard had rendered the Society good service.

He would also be remembered as an early and prominent breeder of pedigree Hackney ponies and as an exhibitor at the Society's shows.

Perhaps there was no Member of the Council so well known as their late colleague, Col. Christopher Wilson, or one whose genial presence would be more greatly missed.

The minutes of the last meeting of the Council, held on November 6, 1918, were taken as read and approved.

Mr. W. Gibson, of Worston, Clitheroe, was elected a Governor, and 30 duly nominated candidates were admitted into the Society as Members.

The following resolution, proposed by Sir JOHN THOROLD, seconded by Mr. F. HAMLYN PRICE, was carried unanimously: "That Mr. G. E. Manwaring, of the London Library, be thanked for his work in compiling the Catalogue of the Society's Library."

Mr. ROGERS, in moving the adoption of the Botanical and Zoological Report, said he would take the opportunity of thanking the Council for the honour they had done him in making him a Vice-President of the Society. He had filled a good many posts in his day, but had never derived more pleasant memories than in connection with the work of the Royal Agricultural Society. It was good of Sir John Thorold to make reference to his small work in connection with the Forestry Exhibition at the Society's shows. He could only say that if there was a continuation of a Forestry Exhibition he hoped that he might have the privilege of being again associated with it.

Col. STANYFORTH, in presenting the Report of the Veterinary Committee in the unavoidable absence of Lord Northbrook, said he would like to say a few words with regard to sheep scab. He considered that the Society should approach the Board of Agriculture again, requesting that increased steps might be taken to eradicate the disease, but that such action might possibly be left until the spring.

With regard to the risk of disease of Army horses, it was thought strongly that such disease was a great danger, and the matter was referred to the War Emergency Committee to bring it before the Board of Agriculture, as it was necessary that proper steps should be taken to avoid any risk of contamination.

On the question of abortion in mares, Sir John McFadyean had said that a good deal of literature had been published, and owners had been asked to report cases of this disease among their mares to the Royal Veterinary College. There was a very great deal of apathy concerning it. He desired to state to the Council that more might be done to notify the disease, and in talking to their friends and breeders, Members should mention that the Royal Veterinary College was always ready to assist.

Mr. DAVIS BROWN said the Principal of the Royal Veterinary College in his annual report told them that it was common knowledge that glanders existed to a considerable extent among Army horses. It would be necessary when the horses were put on the market that they should be isolated for five or six weeks, as if this were not done there was every probability of a spread of glanders all over the country. The matter was a very urgent one, and he would press upon the War Emergency Committee the desirability of taking active steps to deal with the matter.

Sir JOHN MCFADYEAN said that it was stated in the Annual Report that it would be necessary to have the horses isolated and tested. He understood that that duty devolved upon the Army in conjunction with the Board of Agriculture. The Director-General of Remounts had explained that the horses from France or elsewhere to be returned to this country were, subsequent to their return, to be isolated for a fortnight. He thought that these were reasonable and adequate measures to prevent the danger. He considered that it would be a good thing that the attention of the Board of Agriculture should be called to the matter.

With regard to contagious abortion in mares, he could endorse what Col. Stanyforth said as to there appearing to be a certain amount of apathy concerning the disease. He had always explained to those good enough to consult him in the matter, that any questions as to abortion in mares or any other disease is treated as confidential, and he hoped that no case of abortion in mares belonging to Members of the Society should be allowed to pass without the assistance of the Royal Veterinary College being applied for.

The PRESIDENT observed that Mr. U. Roland Burke, the newly-elected Member of Council for Sussex, and Mr. Robert Gray, for Gloucestershire, were present, and, on behalf of the Council, he offered them a hearty welcome.

Sir JOHN THOROLD, before moving the adoption of the Report of the Committee of Selection, said he was sure that the Council would again be glad to welcome the appointment of Sir Gilbert Greenall as Honorary Director of the Show.

The Report of the War Emergency Committee was adopted after discussion, in which Mr. MANSELL and Col. STANYFORTH took part.

THE PRESIDENT said he had received the following cablegram from the President of the Sociedad Rural Argentina, to which he had cabled a reply :

"To President, Royal Agricultural Society,
16, Bedford Square, London.

"Most hearty greetings on the termination of the war and for the triumph obtained.

(Signed) "JOAQUIN S. DE ANCHORENA,
"President, Rural Society."

REPLY.

"To President, Rural Society, Buenos Aires.

"Grateful thanks for kind congratulations on successful termination of the war, and best wishes for continued cordial relations between our two societies.

(Signed) "CECIL T. PARKER,
"President, Royal Agricultural Society of England."

The following Standing Committees were appointed for 1919 :—Finance, Journal and Education, Chemical and Woburn, Botanical and Zoological, Veterinary, Stock Prizes, Implement, Showyard Works, Selection, Dairy and Produce.

The present Members of the various Committees were (with some exceptions) re-appointed to those Committees. Col. C. Venables Llewelyn was added to the Botanical and Zoological Committee, Mr. U. Roland Burke to the Veterinary and Showyard Works Committees, Mr. Robert Gray to the Veterinary Committee, Capt. T. L. Wickham-Boynton to the Stock Prizes Committee, and Lord Middleton, Mr. R. W. Hobbs, and Mr. G. G. Rea to the Committee of Selection.

Proceedings at the Annual General Meeting of Governors and Members,

HELD AT 16, BEDFORD SQUARE, LONDON, W.C.

WEDNESDAY, DECEMBER 11, 1918.

THE HON. CECIL T. PARKER (PRESIDENT), IN THE CHAIR.

Present :—*Trustees.*—The Earl of Coventry, Lord Middleton, the Earl of Northbrook, Sir John H. Thorold, Bart.

Vice-Presidents.—Mr. Ernest Mathews, the Duke of Portland, K.G., Mr. Frederick Reynard, Mr. C. Coltman Rogers, Lieut.-Col. E. W. Stanyforth.

Ordinary Members of the Council.—Mr. H. Dent Brocklehurst, Mr. Davis Brown, Mr. U. Roland Burke, Mr. W. W. Chapman, the Hon. John E. Cross, Sir Walter Gilbey, Bart., Mr. R. Gray, Mr. Joseph Harris, Sir Arthur G. Hazlerigg, Bart., Mr. Robert W. Hobbs, Mr. W. F. Ingram, Mr. J. L. Luddington, Mr. John Myatt, Capt. R. Oliver-Bellasis, Mr. F. Hamlyn Price, Mr. Fred Smith, Mr. Brooking Trant, Capt. J. Bell White, R.N.R., and Capt. T. L. Wickham-Boynton.

Governors and Members.—Mr. Cecil F. Benson, Rev. C. H. Brocklebank, Major Buxton, the Earl of Eldon, Mr. Hope Gibson, Mr. G. W. Gilbanks, Mr. F. S. Gooch, Mr. John T. Mills, Mr. Joseph H. Mills, Mr. J. E. Rouch, Mr. G. F. Sheppard, Mr. J. L. Shirley, Mr. Gershom Simpson, Mr. C. W. Whatley, Mr. George Wood, &c., &c.

On taking the chair, the PRESIDENT said that Governors and Members would have gathered from the note printed in the general meeting report that, owing to the exceptional conditions now prevailing, the meeting had been called *pro formâ* in accordance with the standing orders, and that it was proposed only to take cognisance of the election of ordinary Members of the Council, and then to adjourn the meeting until February 5, 1919, at noon.

Under Bye-law 87 the requisite measures had been taken to fill the vacancies on the Council in the representation of the districts in Group C; and he as President had then formally to report to the annual general meeting the names and addresses of the ordinary Members of the Council who had been elected by the divisions of that group, in order that the meeting might, in the words of the Bye-law, "take cognisance of their election."

To formally fulfil this duty the SECRETARY read out the names of the newly-elected Members, and their election was approved :—

Cumberland: Joseph Harris, Brackenbrough Tower, Carlisle.
Westmorland: Col. C. W. Wilson, Rigmaden Park, Kirkby Lonsdale.
Yorks (East Riding): Capt. T. L. Wickham-Boynton, Burton Agnes Hall, Driffield.
North Wales: Arthur E. Evans, Bronwylfa, Wrexham.
Lincoln: John Evens, Burton, near Lincoln; C. W. Tindall, Wainfleet, S.O.
Huntingdon: John Rowell, Bury, Huntingdon.
Cambridge: J. L. Luddington, Littleport, Ely.
Oxford: Robert W. Hobbs, Kelmscott, Lechlade.
Kent: Thomas L. Aveling, Boley Hill House, Rochester; H. Fitzwalter Plumptre, Goodnestone, near Canterbury.
Warwick: Captain R. Oliver-Bellasis, Shilton House, Coventry.
Gloucester: H. Dent Brocklehurst, Sudeley Castle, Winchcombe; Robert Gray, Sherborne, Northleach.
Glamorgan: D. T. Alexander, Bryneithen, Dinas Powis.
Somerset: Lord Strachie, Sutton Court, Pensford.
Berkshire: W. A. Mount, M.P., Wasing Place, Reading.
Sussex: Walter F. Ingram, 2, St. Andrew's Place, Lewes; U. Roland Burke, Compton Lodge, Eastbourne.
Ireland: Rt. Hon. Frederick Wrench, Killacoona, Ballybrack, co. Dublin.

On the motion of the PRESIDENT, it was unanimously resolved that the general meeting do adjourn until February 5, 1919, at noon, when the remainder of the business would be taken.

Proceedings at the Adjourned General Meeting of Governors and Members,

HELD AT 16, BEDFORD SQUARE, LONDON, W.C.

WEDNESDAY, FEBRUARY 5, 1919.

The Hon. CECIL T. PARKER (President), in the Chair.

Present:—*Trustees.*—Mr. C. Adeane, C.B., Sir J. B. Bowen-Jones, Bart., Sir Gilbert Greenall, Bart., C.V.O., the Earl of Northbrook, Sir John H. Thorold, Bart.

Vice-Presidents.—Mr. Percy Crutchley, the Right. Hon. Sir Ailwyn E. Fellowes, K.C.V.O., Mr. R. M. Greaves, Mr. Ernest Mathews, the Duke of Portland, K.G., Mr. Frederick Reynard, Mr. C. Coltman Rogers, Lieut.-Col. E. W. Stanyforth.

Other Members of the Council.—Mr. D. T. Alexander, Major Clive Behrens, Mr. H. Dent Brocklehurst, Mr. Davis Brown, Mr. U. Roland Burke, Mr. Richardson Carr, Mr. W. W. Chapman, the Hon. J. E. Cross, Mr. J. T. C. Eadie, Mr. A. E. Evans, Mr. John Evens, Mr. James Falconer, Mr. W. Fitzherbert-Brockholes, Capt. W. H. France-Hayhurst, Mr. Robert Gray, Lord Harlech, Mr. Arthur Hiscock, Mr. R. W. Hobbs, Mr. John Howard Howard, Mr. W. F. Ingram, Col. C. Venables Llewelyn, Mr. J. L. Luddington, Mr. Alfred Mansell, Earl Manvers, Mr. Christopher Middleton, Mr. G. Norris Midwood, Mr. W. A. Mount, M.P., Mr. John Myatt, Capt. R. Oliver-Bellasis, Mr. Henry Overman, Mr. R. G. Patterson, Mr. H. F. Plumptre, Mr. F. Hamlyn Price, Mr. G. G. Rea, Mr. Fred Smith, Mr. C. Howard Taylor, Mr. A. P. Turner and Col. E. V. V. Wheeler.

Governors.—The Rev. C. H. Brocklebank, Mr. William Gibson, Mr. H. H. Vivian.

Members.—Messrs. Edward Akers, William Bainbridge, Capt. E. R. P. Bond, R.F.A., Messrs. J. F. Crewes, F. C. Fendick, G. A. Fillingham, F. L. Gooch, William Graham, J. E. Jones, W. S. MacWilliam, C. Morris, F. S. Peer, Alderman Iltyd Thomas, Messrs. Tom Thomson, Eldred G. F. Walker, J. Wilkes, Lieut. George Wood, &c., &c.

The PRESIDENT, explaining why the General Meeting had been adjourned until that day, said that in December it was uncertain whether the Show was to be held at Cardiff this year, and it was considered that by the present time the Society would be better informed on the subject. It had also been hoped that H.R.H. the Prince of Wales would have been able to accept the Presidency, but after considerable correspondence he had the previous evening received the following telegram :—

> The Hon. Cecil Parker, 16 Bedford Square, London.
> Please convey to the Council of the Royal Agricultural Society the Prince of Wales's deep regret that he is unable to accept the Presidency for this year. H.R.H. is still in France, and it is not possible for him to make any engagements at present. (Signed) GREVILLE, Comptroller.
> Sandringham.

The PRESIDENT, continuing, said that death had unfortunately been very busy during the past year and the Society had lost many Governors and Members. It was gratifying however, to know that the membership continued to increase, and that there was every prospect of further increase in the future. Perhaps the most important section of the annual report was that relating to the work of the War Emergency Committee, and he thought that the Society was particularly indebted to its representatives on the Central Advisory Council. The thanks of agriculturists generally were due in large measure to Lord Northbrook, Mr. Evens, Mr. Mansell and Mr. Overman for attending the meetings of the Advisory Council and giving their valuable suggestions and advice.

The Rev. C. H. BROCKLEBANK (Cambridge) moved the adoption of the annual report, expressing the hope that the War Emergency Committee would continue its efforts on behalf of the farmers of England. Speaking as an ordinary, practical farmer he could not help saying that farmers were being squeezed very tightly just at present. The Wages Board were putting up wages in his own district to a prohibitive and absurd level, and it was asserted that a boy of eighteen was worth 32s. a week the moment he went on to a farm to learn a horse. If the War Emergency Committee could enable farmers to be left free to manage their own affairs in their own way, and to get freedom of contract restored, that body would be doing great service. (Hear, hear.) For his part he would prefer to be left free to do the best he could with the land when he knew how to farm, and he objected to being

taken by the ears and told how to farm his own land. If the Government thought they could do it better than he could, let them come in and pay him cost price and he would walk out. He sincerely hoped that the War Emergency Committee would continue its efforts to regain for farmers their freedom.

Mr. MACWILLIAM seconded the motion, and the report was adopted.

Mr. EDWARD AKERS (Glamorganshire) said he felt very much honoured in being allowed to propose the election of Sir J. B. Bowen-Jones, Bart., as the President of the Society for the ensuing year. Sir Bowen was the senior member of the Council, and was highly esteemed, not only by the Council, but by agriculturists throughout the area of South Wales. He felt sure that the members would agree with him that it was both fitting and helpful that Sir Bowen should be their President during the present year when the show was to be held at Cardiff.

Alderman ILLTYD THOMAS, of Cardiff, seconded the proposition, and said that the election of Sir J. B. Bowen-Jones would be a matter of gratification to Welsh agriculturists, inasmuch as he was of Welsh extraction. Welshmen would indeed appreciate the compliment the Society was paying to the Principality as well as to Sir Bowen in making him their President.

The motion was carried with applause.

Sir J. B. BOWEN-JONES warmly thanked the proposer and seconder of the resolution for the kind words they had used in putting his name forward as President of that great Society. It was very difficult fully to express all that he felt upon being placed in so responsible a position, for any man, in whatever sphere of life he might be, must be proud of being called to occupy so prominent and important a position, and this applied more strongly to one who, like himself, had been engaged for the greater part of his life in practical agricultural work. With the assistance of his colleagues on the Council and the members generally of the Society he could promise them it would be his endeavour to do all within his power, and to the utmost of his ability to uphold the great traditions of the Society, and to promote and advance its interests during his year of office. He was sure that if he was spared he should always look back with justifiable pride and satisfaction upon having been placed in the honourable position to which they had that day called him. (Applause.)

The PRESIDENT announced that the following twelve Trustees had been nominated by the Council in accordance with the by-laws :—

Adeane, C., C.B., Babraham Hall, Cambridge,
Bedford, Duke of, K.G., Woburn Abbey, Bedfordshire.
Bowen-Jones, Sir J. B., Bart., Council House Court, Shrewsbury.
Cornwallis, Col. F. S. W., Linton Park, Maidstone, Kent.
Coventry, Earl of, Croome Court, Severn Stoke, Worcestershire.
Devonshire, Duke of, K.G., Government House, Ottawa, Canada.
Greenall, Sir Gilbert, Bart., C.V.O., Walton Hall, Warrington.
Middleton, Lord, Birdsall House, Malton, Yorks.
Moreton, Lord, Sarsden House, Kingham, Oxford.
Northbrook, Earl of, Stratton, Micheldever, Hampshire.
Parker, Hon. Cecil T., The Grove, Corsham, Wiltshire.
Thorold, Sir John H., Bart., Old Hall, Syston, Grantham.

On a show of hands the above gentlemen were declared elected as Trustees to hold office until the next ensuing annual general meeting.

The Vice-Presidents, whose names were as follows, were elected in a similar manner :—

Crutchley, Percy, Sunninghill Lodge, Ascot, Berkshire.
Derby, Earl of, K.G., Knowsley, Prescot, Lancashire.
Fellowes, Rt. Hon. Sir Ailwyn E., K.C.V.O., Honingham, Norwich.
Greaves, R. M., Wern, Portmadoc, North Wales.
Mathews, Ernest, Little Shardeloes, Amersham, Bucks.
Portland, Duke of, K.G., Welbeck Abbey, Worksop, Notts.
Powis, Earl of, Powis Castle, Welshpool, Mont.
Reynard, Frederick, Sunderlandwick, Driffield, Yorkshire.
Richmond and Gordon, Duke of, K.G., Goodwood, Chichester.

Rogers, C. Coltman, Stanage Park, Brampton Bryan.
Stanyforth, Lt.-Col E. W., Kirk Hammerton Hall, York.
Yarborough, Earl of, Brocklesby Park, Lincolnshire.

Mr. J. F. CREWES (Cornwall) then moved the following resolution :—

"That the best thanks of the Society be tendered to Messrs. Jonas M. Webb, Hubert J. Greenwood, and Newell P. Squarey, for their services as auditors, and that they be re-elected for the ensuing year."

Mr. CREWES said these gentlemen had proved their ability and had kindly consented to act again.

The motion was seconded by Mr. GOOCH and carried.

In response to the President's inquiry as to whether there were any suggestions to be made by Governors or Members for the consideration of the Council, Mr. WILLIAM GRAHAM (Eden Grove) said he wished to call the attention of the War Emergency Committee to the conditions prevailing now in relation to the prices of cereals fixed under the Corn Production Act. Farmers had been placed in a very false position by the passing of the Corn Production Act, in which prices were fixed on the assumption that the minimum wage of the labourer would be 25*s*. Since then wages had doubled. The price of wheat and other agricultural produce was higher, but there was no guarantee that the present prices were to be maintained. He was informed by many of his friends that although they had wheat on their hands at the prices guaranteed by the Government they were quite unable at the moment to find a market for it, and dealers were not relieving them of the wheat at the prices fixed. This state of things ought not to be allowed to go on any longer, and he believed that if representations were to be made by the War Emergency Committee of the Society it would have effect. He would suggest that the Government should be requested to revise the Corn Production Act so that the prices guaranteed for grain should be brought to a level corresponding with the increased rate of wages. The Wages Boards, who had forced farmers to submit to the new rates, were packed bodies throughout the country. The Board of Agriculture had the right to appoint the Chairman and the Secretary, and some of the members of the Wages Boards, and it was no uncommon thing to see tailors, joiners, and others quite unconnected with agriculture sitting upon those bodies. Although the wages in the past might have been small in comparison with those of the present day, other circumstances must be taken into consideration, as the workmen had received very great assistance from their employers in other ways.

Mr. PATTERSON said he could not allow the remarks of Mr. Graham to pass without a certain protest. It would be very dangerous if there went forth from the Royal Agricultural Society anything suggesting that the Members grudged the agricultural labourer his wage.

Mr. GRAHAM denied that he had said anything of the kind.

Mr. PATTERSON said that he must express his dissent from the spirit of Mr. Graham's speech. When the Corn Production Act was introduced practically no farmer raised any objection to the wages fixed by the Act as being fair in regard to the prices fixed for the corn. There was no protest raised, and the workers were entitled to say that if 25*s*. was a fair minimum wage in proportion to the prices fixed under the Act they were entitled to considerably more in view of the fact that wheat and other cereals were fetching very much higher prices than those fixed. The agricultural labourer in a great many cases throughout the country has stuck to the farm when he could have received very much higher wages by going into other industries. He admitted, of course, that there were exceptions. The wages fixed by the Wages Board for agricultural labourers were very much less than those in any other industry. He ventured to tell the farmers of Great Britain that the Wages Board had not in any way overlooked or neglected the interests of the employers, but had endeavoured, having regard to the existing conditions of affairs, to deal fairly with both employers and workers.

(Hear, hear.) It could not be said that the agricultural labourer was overpaid to-day. The cost of living had gone up 100 per cent., and the labourer's position was very little better, if any, than it was formerly. If the agricultural community was satisfied that the pre-war position of the agricultural labourer should continue, his own opinion was that it was a great reflection upon that community.

Mr. DAVIS BROWN said he agreed almost entirely with what Mr. Patterson had said, but there was nothing in Mr. Graham's suggestion that the previous speaker had to complain of. There was nothing expressing opposition to a fair and even liberal wage being paid. The only thing suggested was that the guaranteed prices of corn should be raised in proportion to the rise in the cost of labour. His own opinion was that the Corn Production Act had been accepted by the farmer without close acquaintance with its contents. In his own district he believed he was the only one to stand up and say what the Act would mean to the farmers. It seemed to him that the question was one of both wages and the controlled prices of corn being dealt with on similar lines. What was amiss was that they were dealt with by different Government Departments. The President of the Board of Agriculture, in a statement at Norwich, made the definite promise that if the costs of production were increased the controlled prices of their produce should also be increased.

The PRESIDENT promised that the matter brought forward by Mr. Graham should be considered by the War Emergency Committee.

Mr. T. THOMSON (Shropshire) proposed a hearty vote of thanks to the President for his services during the past year. No President, he said, had undertaken the duties and responsibilities of the office at a more anxious time than Mr. Parker. Twelve months ago no one could see how we were going to emerge from the difficult situation in which we were then placed, and they owed him a debt of thanks for the splendid way in which he had carried out the duties of his office and maintained the honour of the Society during the past year. (Hear, hear.) Mr. Parker had not had the pleasure of presiding over the affairs of the Council during a great show. His work had been of a much more humdrum character, and they owed him their gratitude the more on that account. As a Shropshire man he took the liberty of expressing, on behalf of Shropshire farmers, the pride they felt at the election of Sir J. B. Bowen-Jones as President in succession to Mr. Parker. Sir Bowen Bowen-Jones was greatly respected by Shropshire agriculturists, and was a golden exception to the statement that a prophet was without honour in his own country. (Applause.)

MR. ELDRED WALKER (Somersetshire) seconded the motion, and said that it was very largely due to their President that the Royal Agricultural Society stood so high in public estimation as it did to-day. (Hear, hear.) Many of the agricultural societies had adopted a dormouse policy, and were still asleep. The "Royal," however, had done its work all through this trying time without the glamour of a show, and agriculturists throughout the country admired the work of the Emergency Committee and the resolutions it had passed. The President had endeared himself to all farmers in Wiltshire and Somerset. (Hear, hear.) He had not only done his work as President, but he had been an active member of that very useful body, the Central Advisory Council. (Applause.)

The resolution having been carried amid applause, the PRESIDENT expressed his sincere thanks to the Members for their kind expressions. He assured them that it had not only been a great honour to preside over the deliberations of the Council, but it had been a pleasure, and he was most grateful to the Council for their kindness, and to Mr. McRow and his able assistants for the work they had done. (Hear, hear.) He regretted very much that there had not been a show during his period of office, but he had the satisfaction of knowing that the year had been signalised by the signing of the Armistice. (Applause.)

The proceedings then terminated.

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Halve the heap obtained in either of these ways, take one half (rejecting the other) and mix again rapidly, flattening down with the shovel any lumps that appear. Repeat this operation until at last only some three or four pounds are left.

From this fill three tins, holding from ½ lb. to 1 lb. each, mark, fasten up and seal each of these. Send one for analysis, and retain the others for reference.

Or,—the manure may be put into glass bottles provided with well-fitting corks; the bottles should be labelled and the corks sealed down. The sample sent for analysis can be packed in a wooden box and sent by post or rail.

When manures are delivered in bulk, portions should be successively drawn from *different parts* of the bulk, the heap being turned over now and again. The portions drawn should be thoroughly mixed, subdivided, and, finally, samples should be taken as before, except that when the manure is coarse and bulky it is advisable to send larger samples than when it is in a finely divided condition.

Linseed, Cotton, and other Feeding Cakes.—If a single cake be taken, three strips should be broken off right across the cake, and from the middle portion of it, one piece to be sent for analysis, and the other two retained for reference. Each of the three pieces should be marked, wrapped in paper, fastened up, and sealed. The piece forwarded for analysis can be sent by post or rail.

A more satisfactory plan is to select four to six cakes from different parts of the delivery, then break off a piece about four inches wide from the middle of each cake, and pass these pieces through a cake-breaker. The broken cake should then be well mixed and three samples of about 1 lb. each should be taken and kept in tins or bags, duly marked, fastened, and sealed as before. One of these lots should be sent for analysis, the remaining two being kept for reference. It is advisable also with the broken pieces to send a small strip from an unbroken cake.

Feeding Meals, Grain, &c.—Handfuls should be drawn from the centre of half a dozen different bags of the delivery; these lots should then be well mixed, and three ½-lb. tins or bags filled from the heap, each being marked, fastened up, and sealed. One sample is to be forwarded for analysis and the others retained for reference.

Soils.—Have a wooden box made 6 inches in length and width, and from 9 to 12 inches deep, according to the depth of soil and subsoil of the field. Mark out in the field a space of about 12 inches square; dig round in a slanting direction a trench, so as to leave undisturbed a block of soil and its subsoil 9 to 12 inches deep; trim this block to make it to fit into the wooden box, invert the open box over it, press down firmly, then pass a spade under the box and lift it up, gently turn over the box, nail on the lid, and send by rail. The soil will then be received in the position in which it is found in the field.

In the case of very light, sandy, and porous soils, the wooden box may be at once inverted over the soil, forced down by pressure, and then dug out.

Waters.—Samples of water are best sent in glass-stoppered Winchester bottles, holding half a gallon. One such bottle is sufficient for a single sample. Care should be taken to have these scrupulously clean. In taking a sample of water for analysis it is advisable to reject the first portion drawn or pumped, so as to obtain a sample of the water when in ordinary flow. The bottle should be rinsed out with the water that is to be analysed, and it should be filled nearly to the top. The stopper should be secured with string, or be tied over with linen or soft leather. The sample can then be sent carefully packed either in a wooden box with sawdust, &c., or in a hamper with straw.

Milk.—A pint bottle should be sent in a wooden box.

GENERAL INSTRUCTIONS. Time for Taking Samples.—All samples, both of fertilisers and feeding stuffs, should be taken as soon after their delivery as possible, and should reach the Analyst within *ten days* after delivery of the article. In every case it is advisable that the Analyst's certificate be received before a fertiliser is sown or a feeding stuff is given to stock.

Procedure in the Event of the Vendor wishing Fresh Samples to be Drawn.—Should a purchaser find that the Analyst's certificate shows a fertiliser or feeding stuff not to come up to the guarantee given him, he may inform the vendor of the result and complain accordingly. He should then send to the vendor *one* of the two samples which he has kept for reference. If, however, the vendor should demand that a fresh sample be drawn, the purchaser must allow this, and also give the vendor an opportunity of being present, either in person or through a representative whom he may appoint. In that case three samples should be taken in the presence of both parties with the same precautions as before described, *each* of which should be duly packed up, labelled and *sealed* by both parties. One of these is to be given to the vendor, one is to be sent to the Analyst, and the third is to be kept by the purchaser for reference or future analysis if necessary.

Suggestions to Purchasers of Fertilisers and Feeding Stuffs.

Purchasers are recommended in all cases to insist on having an **INVOICE**, and to see that such invoice contains the following particulars:—

In the case of **Fertilisers**:—

(1) The *name* of the Fertiliser.
(2) Whether the Fertiliser is artificially *compounded* or not.
(3) The *minimum* analysis of the Fertiliser in respect of its principal fertilising ingredients.

In the case of artificially prepared **Feeding Stuffs** for Cattle:—

(1) The *name* of the article.
(2) The *description* of the article—whether it has been prepared (*a*) from one substance or seed, or (*b*) from more than one substance or seed.
(3) The percentages of oil and albuminoids guaranteed.

For example:

(*a*) An invoice describing an article as "Linseed Cake" implies a warranty that the article is pure, *i.e.*, is prepared from linseed only; "Cotton Cake" (whether decorticated or undecorticated), and "Rape Cake" (for feeding purposes), would come under a similar category.

Purchasers are reminded that the use of such terms as "95 per cent.," "Oil Cake," &c., affords no security against adulteration. The adoption of the ORDER FORM *issued by the Society is therefore strongly recommended.*

(*b*) In the case of a Compound Cake or Feeding Stuff, a Vendor is compelled by the Fertilisers and Feeding Stuffs Act of 1906 to state the percentages of oil and albuminoids guaranteed, and that it is prepared from more than one substance, but he is not required to specify the particular materials used in its preparation. Purchasers are recommended, therefore, to buy Mixed Feeding Cakes, Meals, &c., with a guaranteed analysis. Any statements in the invoice as to the component parts of such Mixed Cake or Meal will take effect as a warranty, as also will any statements in an invoice, circular, or advertisement as to the percentages of nutritive and other ingredients in any article sold for use as food for cattle.

Members of the Society are strongly recommended not only to see that the invoices given to them accurately describe the goods they have ordered, but to make all their orders *subject to the Analysis and Report of the Consulting Chemist of the Royal Agricultural Society of England.* Copies of a Form of Order (see page v.) for this purpose may be obtained on application to the Secretary.

Attention is particularly directed to the recommendations below as to the qualities of Fertilisers and Feeding Stuffs which purchasers should demand.

Conditions of Purchase and Sale.

FERTILISERS.

Raw Bones, Bone-meal, or Bone-dust to be guaranteed "PURE," and to contain not less than 45 per cent. of Phosphate of Lime, and not less than 4 per cent. of Ammonia.

Steamed or "Degelatinized" Bones to be guaranteed "PURE," and to contain not less than 55 per cent. of Phosphate of Lime, and not less than 1 per cent. of Ammonia.

Mineral Superphosphate of Lime to be guaranteed to contain a certain percentage of "Soluble Phosphate." [From 25 to 28 per cent. of Soluble Phosphate is an ordinarily good quality.]

Dissolved Bones to be guaranteed to be "made from raw bone and acid only," and to be sold as containing stated minimum percentages of Soluble Phosphate, Insoluble Phosphates, and Ammonia.

Compound Artificial Manures, Bone Manures, Bone Compounds, &c., to be sold by analysis stating the minimum percentages of Soluble Phosphate, Insoluble Phosphates, and Ammonia contained.

Basic Slag to be guaranteed to contain a certain percentage of Total phosphates or of "Citric soluble" phosphates (*i.e.*, phosphates soluble in a 2 per cent. citric acid solution), and to be sufficiently finely ground that at least 80 per cent. will pass through a "standard" sieve (10,000 meshes to the square inch).

The highest grades of Basic Slag range from 38 to 42 per cent., medium grades from 30 to 35 per cent., and low grades from 21 to 26 per cent. of Total phosphates.

Generally speaking, at least 80 per cent. of the Total phosphates in a Basic Slag are soluble in the citric acid solution above mentioned. Accordingly, a high grade Basic Slag would contain from 30 to 34 per cent., a medium grade from 24 to 28 per cent., and a low grade from 17 to 21 per cent. of "citric soluble" phosphates.

Peruvian Guano to be described by that name, and to be sold by analysis stating the minimum percentages of Phosphates and Ammonia.

Sulphate of Ammonia to be guaranteed "PURE," and to contain not less than 24 per cent. of Ammonia.

Nitrate of Soda to be guaranteed "PURE," and to contain 95 per cent. of Nitrate of Soda.

Kainit to be guaranteed to contain 23 per cent. of Sulphate of Potash.

All Fertilisers to be delivered in good and suitable condition for sowing.

FEEDING STUFFS.

Linseed Cake, Cotton Cake (Decorticated and Undecorticated), and **Rape Cake** (for feeding purposes) to be pure, *i.e.*, prepared *only* from the one kind of seed from which their name is derived; and to be in sound condition. The percentages of oil and albuminoids guaranteed must also be stated. The Report of the Consulting Chemist of the Royal Agricultural Society of England to be conclusive as to the "purity" or otherwise of any feeding stuffs.

Mixed Feeding Cakes, Meals, &c., to be sold on a guaranteed analysis, giving the percentages of oil and albuminoids, to be sound in condition, and to contain nothing of an injurious nature, or ingredients that are worthless for feeding purposes.

ORDER FORM (SAMPLE)

FOR FERTILISERS OR FEEDING STUFFS.

Address .....

To .....

.....

Date .....

Please supply me for Delivery .....

..... *Cwt. of* .....

At ..... *per ton.*

GUARANTEED to be in accordance with the conditions specified on the back hereof, relating to this article, and subject to the analysis and report of the Consulting Chemist of the Royal Agricultural Society of England.

(*Signature of Member*) .....

NOTE.—Copies of this Form will be forwarded to Members on application to the Secretary.

[P.T.O.

CONDITIONS OF PURCHASE AND SALE.

FERTILISERS.

Raw Bones, Bone-meal, or **Bone-dust** to be guaranteed "PURE," and to contain not less than 45 per cent. of Phosphate of Lime, and not less than 4 per cent. of Ammonia.

Steamed or "Degelatinized" Bones to be guaranteed "PURE," and to contain not less than 55 per cent. of Phosphate of Lime, and not less than 1 per cent. of Ammonia.

Mineral Superphosphate of Lime to be guaranteed to contain a certain percentage of "Soluble Phosphate." [From 25 to 28 per cent. of Soluble Phosphate is an ordinarily good quality.]

Dissolved Bones to be guaranteed to be "made from raw bone and acid only," and to be sold as containing stated minimum percentages of Soluble Phosphate, Insoluble Phosphates, and Ammonia.

Compound Artificial Manures, Bone Manures, Bone Compounds, &c., to be sold by analysis stating the minimum percentages of Soluble Phosphate, Insoluble Phosphates, and Ammonia contained.

Basic Slag to be guaranteed to contain a certain percentage of Total phosphates or of "Citric soluble" phosphates (*i.e.*, phosphates soluble in a 2 per cent. citric acid solution), and to be sufficiently finely ground that at least 80 per cent. will pass through a "standard" sieve (10,000 meshes to the square inch).

The highest grades of Basic Slag range from 38 to 42 per cent., medium grades from 30 to 35 per cent., and low grades from 21 to 26 per cent. of Total phosphates.

Generally speaking, at least 80 per cent. of the Total phosphates in a Basic Slag are soluble in the citric acid solution above mentioned. Accordingly, a high grade Basic Slag would contain from 30 to 34 per cent., a medium grade from 24 to 28 per cent., and a low grade from 17 to 21 per cent. of "citric soluble" phosphates.

Peruvian Guano to be described by that name, and to be sold by analysis stating the minimum percentages of Phosphates and Ammonia.

Sulphate of Ammonia to be guaranteed "PURE," and to contain not less than 24 per cent. of Ammonia.

Nitrate of Soda to be guaranteed "PURE," and to contain 95 per cent. Nitrate of Soda.

Kainit to be guaranteed to contain 23 per cent. of Sulphate of Potash.

All Fertilisers to be delivered in good and suitable condition for sowing.

FEEDING STUFFS.

Linseed cake, Cotton cake (Decorticated and Undecorticated), and **Rape cake** (for feeding purposes) to be pure, *i.e.*, prepared *only* from the one kind of seed from which their name is derived; and to be in sound condition. The percentages of oil and albuminoids guaranteed must also be stated. The Report of the Consulting Chemist of the Royal Agricultural Society of England to be conclusive as to the "purity" or otherwise of any feeding stuffs.

Mixed Feeding-cakes, Meals, &c., to be sold on a guaranteed analysis, giving the percentages of oil and albuminoids, to be in sound condition, and to contain nothing of an injurious nature, or ingredients that are worthless for feeding purposes.

MEMBERS' BOTANICAL PRIVILEGES.

THE COUNCIL HAVE FIXED THE FOLLOWING

RATES OF CHARGES FOR THE EXAMINATION OF PLANTS AND SEEDS

BY THE SOCIETY'S BOTANIST.

Analyses are given on the understanding that they are required for the individual and sole benefit of the member applying for them, and must not be used for other persons or for commercial purposes. The analyses and Reports may not be communicated to the vendor except in cases of dispute.

The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid. When, however, *bonâ fide* inquiries require no special investigation the fees will be returned with the reply.

1.—Report on the purity and germinating capacity of samples of agricultural seeds, with a statement as to the nature and amount of the impurities or adulterants present . 1s.

2.—Report on the constitution of mixtures of grass seeds and an opinion as to their suitability for temporary leys, permanent pastures, &c. . . . . 1s.

3.—Identification of weeds and poisonous plants with suggestions for their eradication . . . . . 1s.

4.—Report on the fungoid diseases affecting farm crops, with an account of the methods suitable for their treatment, where known . . . . . 1s.

5.—Report on the natural herbage of a district as a guide to the formation of permanent pastures . . . . 1s.

6.—Report on the suitability or otherwise of the different varieties of the chief farm crops for local conditions (where the information is available), stating their average cropping capacity as compared with other varieties, their quality, power of resistance to various diseases, and general purity to type . . . . . 1s.

7.—Reports on any other matters of a botanical nature of interest to agriculturists . . . . . 1s.

PURCHASE OF SEEDS.

The purchaser should obtain from the vendor, by invoice or other writing, the proper designation of the seeds he buys, with a guarantee of the percentage of purity and germination, and of its freedom from ergot, and, in the case of clover, from the seeds of dodder.

Copies of the "Order Form and Conditions of Purchase and Sale of Seeds" (see page ix) may be obtained by Members on application to the Secretary, at 16 Bedford Square, London, W.C. 1.

MEMBERS' BOTANICAL PRIVILEGES (*continued*).

THE SAMPLING OF SEEDS.

The utmost care should be taken to secure a fair and honest sample. This should be drawn from the bulk delivered to the purchaser, and not from the sample sent by the vendor.

When legal evidence is required, the sample should be taken from the bulk, and placed in a sealed bag in the presence of a witness. Care should be taken that the sample and bulk be not tampered with after delivery, or mixed or brought in contact with any other sample or bulk.

At least one ounce of grass and other small seeds should be sent, and two ounces of cereals and the larger seeds. When the bulk is obviously impure, the sample should be at least double the amount specified. Grass seeds should be sent at least four weeks, and seeds of clover and cereals two weeks before they are to be used.

The exact name under which the sample has been sold and analysed should accompany it.

REPORTING THE RESULTS.

The Report will be made on a schedule in which the nature and amount of impurities will be stated, and the number of days each sample has been under test, with the percentage of the seeds which have germinated.

"Hard" clover seeds, though not germinating within the time stated, will be considered good seeds, and their percentage separately stated.

The impurities in the sample, including the chaff of the species tested, will be specified in the schedule, and only the percentage of the pure seed of that species will be reported upon; but the REAL VALUE of the sample will be stated. The Real Value is the combined percentages of purity and germination, and is obtained by multiplying these percentages and dividing by 100; thus in a sample of Meadow Fescue having 88 per cent. purity and 95 per cent. germination, 88 multiplied by 95 gives 8,360, and this divided by 100 gives 83·6, the Real Value.

SELECTING SPECIMENS OF PLANTS.

When a specimen is sent for determination, the whole plant should be taken up and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. They should be placed in a bottle, or packed in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

PARCELS OR LETTERS CONTAINING SEEDS OR PLANTS FOR EXAMINATION MUST BE ADDRESSED (CARRIAGE OR POSTAGE PREPAID) TO—

PROFESSOR R. H. BIFFEN, F.R.S.,
School of Agriculture, Cambridge.

ORDER FORM (SAMPLE)

AND

CONDITIONS OF PURCHASE AND SALE OF SEEDS.

FROM	TO
.....	.....
.....	.....

PLEASE SUPPLY me for Delivery the Seeds specified in the ORDER FORM on the back hereof, it being guaranteed that each kind of seed is practically free from impurities: that the Grass seeds are free from Ergot, and the Clovers free from Dodder: that the germination is not less than is specified on the back hereof: and further that the purchase is subject to the examination and germination tests of the Botanist of the Royal Agricultural Society of England, whose opinion shall be final.

(Signature of Member).....

Date.....

NOTE.—Copies of this Form will be forwarded to Members on application to the Secretary.

P.T.O

MEMBERS' ZOOLOGICAL PRIVILEGES.

The Council have fixed the charge of 1s. for information to be supplied, by the Society's Zoologist, respecting any injurious (animal, quadruped, bird, insect, worm, &c.) pests.

(1) FARM CROPS.

All the ordinary farm crops are subject to numerous pests, some attacking the roots, some the leaves, others the stem or the blossom. The first necessity is the accurate identification of the pest in any case, for a knowledge of its life-history often suggests a method of dealing with it.

(2) FRUIT TREES.

There are a great number of orchard and bush-fruit pests. Some (codlin moth, pear-midge, &c.) attack the fruit; others (red-spider, aphis, caterpillars, &c.) the leaves; others (woolly aphis, boring beetles, &c.) the stem. Information will be given as to the identity of any pest and the best way of combating it.

(3) FOREST TREES.

Advice will be given with regard to the treatment of forest-tree pests, in plantations, nursery gardens, or ornamental grounds. Such pests may attack the trunks (beech-scale, boring insects, &c.), the leaves (caterpillars, aphis, &c.), or the roots (cockchafer grubs, &c., in young plantations).

(4) DOMESTICATED ANIMALS.

Animal parasites, whether external or internal, may be sent for identification and advice. They include worms, fly-maggots, ticks, lice, &c., and many well-known diseases (warbles, gapes, &c.) are due to them.

Diseases of animals due to other causes should be referred to the Veterinary Department.

N.B.—It is very important that specimens should reach the Zoologist fresh and in good condition. It is often impossible to determine the cause of injury in the case of crushed and shrivelled material. Tin boxes should be used, and some damp blotting-paper inserted to prevent undue drying. In the case of root-pests, the root should be sent with its surrounding soil.

PARCELS OR LETTERS CONTAINING SPECIMENS (CARRIAGE OR POSTAGE PAID) MUST BE ADDRESSED TO—

Mr. CECIL WARBURTON, M.A.,
School of Agriculture, Cambridge.

MEMBERS' VETERINARY PRIVILEGES.

In order to enable Members to obtain the highest possible Veterinary advice when the necessity arises, the Society has entered into an agreement with the Royal Veterinary College, under which diseased animals may be admitted to the College Infirmary for treatment, and the Professors of the College may be consulted or called upon to investigate outbreaks of disease at greatly reduced fees.

I.—ADMISSION OF SICK OR DISEASED ANIMALS TO THE ROYAL VETERINARY COLLEGE.

Members of the Society have all the privileges of subscribers to the Royal Veterinary College, Camden Town, N.W.1., so far as the admission for treatment of Cattle, Sheep, and Swine is concerned, without being called upon to pay the annual subscription to the College of two guineas. The charges made by the College for keep and treatment are as follows :—Cattle, 10*s.* 6*d.*, and Sheep and Pigs, 3*s.* 6*d.* per week for each animal.

The full privileges of subscribers, including the examination of horses, and the admission of horses and dogs into the College Infirmary for surgical or medical treatment, on payment of the cost of keep, will be accorded to Members of the Society on payment of a subscription to the College of one guinea instead of two guineas per annum.

II.—FEES FOR CONSULTATIONS, ANALYSES, AND EXAMINATIONS AT THE ROYAL VETERINARY COLLEGE.

The following fees are payable by Members of the Society for services performed at the Royal Veterinary College on their behalf in cases where a visit to the locality is not involved:—

	£	*s.*	*d.*
Personal consultation with a Veterinary Professor		10	6
Consultation by letter		10	6
Post-mortem examination of an animal and report thereon	1	1	0
Chemical Examination of viscera for any specified metallic poison		10	6
Chemical Examination of viscera for metallic poisons	1	0	0
Chemical Examination of viscera for vegetable poisons	1	0	0
Chemical Examination of viscera complete, for metals and alkaloids	2	0	0

(The above fees do not apply to cases which involve a visit to the locality.)

III.—INVESTIGATION OF OUTBREAKS OF DISEASE AMONG FARM STOCK.

In the event of any obscure outbreak of disease among Cattle, Sheep, or Swine occurring on the farm of any Member of the Society, application should at once be made to the PRINCIPAL of the ROYAL VETERINARY COLLEGE, CAMDEN TOWN, LONDON, N.W.1.

The Principal will then instruct an officer of the College to inquire into the outbreak and report to him. He will also fix the amount of remuneration to be paid to the Inspector, whose professional fee will in no case exceed two guineas per day, exclusive of the actual cost of travelling and maintenance.

When it appears, on the report of the Inspector selected, that the outbreak was of an important character or of general interest, the cost of the investigation will be defrayed by the Royal Veterinary College.

LIBRARY.

The Society's Library has recently been re-arranged and a printed Catalogue prepared of the Agricultural and other works which it contains. This Catalogue can be purchased by Members at the Society's House, price 17/6 per copy.

A Librarian has been appointed, and the following regulations have been made by the Council :—

1. The Library is open every week day from 10 till 4, except on Saturdays, and on those days when the Council and Committees are meeting.

2. Governors and Members are entitled to take out books, upon paying the carriage of the same and all expenses from the time of issue to the time of return. Books of reference and selected books will not be issued.

3. One month is allowed for the perusal of books.

4. Governors and Members shall be liable to pay the full price of any books borrowed by them which may be lost or damaged during the interval between their issue and return.

PUBLICATIONS OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

JOURNAL OF THE SOCIETY.

Now published as an Annual Volume of about 500 pages in paper covers. Free to Members. Price to Non-Members Ten Shillings.

TEXT-BOOK ON AGRICULTURE.

ELEMENTS OF AGRICULTURE: a Text-book prepared under the authority of the Royal Agricultural Society of England by the late W. FREAM, LL.D. Tenth (Revised and Enlarged) Edition (Ninth Thousand), edited by J. R. AINSWORTH-DAVIS, M.A. 590 pp. with 333 Illustrations. 1913. Price 7s. 6d. nett, bound in cloth.

FARM ACCOUNT BOOKS.

No. 1. A DIARY, containing Cash Account with daily record of Farm Transactions. Price 4s.

No. 2. A FARM ACCOUNT BOOK, 2nd Edition, showing payments and receipts and supplying a form of Annual Balance Sheet. Price 2s. 6d. Published for the Society and sold by Messrs. FORSTER, GROOM & CO., Ltd., 15 Charing Cross, London, S.W.1.

No. 3. FARM CASH BOOK, receipts and payments to be used with a Ledger. Price 2s. 6d.

No. 4. FARM LEDGER, giving open-item entries and particulars of profit and loss account and balance sheet. Price 2s. 6d.

Nos. 3 and 4 are to be obtained at the Society's House, 16 Bedford Square, London, W.C. 1.

PAMPHLETS.

VETERINARY PAMPHLETS BY PROFESSOR SIR GEORGE BROWN, C.B.:

DENTITION AS INDICATIVE OF THE AGE OF FARM ANIMALS. Sixth Edition (1913). 64 pp. With 60 Illustrations. Price 1s.

ANIMALS OF THE FARM IN HEALTH AND DISEASE. 72 pp. With 52 Illustrations. Fourth Edition (1900). Price 1s.

THE STRUCTURE OF THE HORSE'S FOOT AND THE PRINCIPLES OF SHOEING. 23 pp. Fourth and Enlarged Edition (1902). With 12 Illustrations. Price 6d.

CONTAGIOUS FOOT ROT OF SHEEP. Second and Enlarged Edition (1905). 24 pp. With 8 Illustrations. Price 1s.

OTHER VETERINARY PAMPHLETS:

THE MARE AND FOAL. By Professor J. WORTLEY AXE, M.R.C.V.S. 52 pp. With 20 Illustrations. Second Edition (1900). Price 1s.

THE LAMBING PEN. By HAROLD LEBNEY. 2nd Ed. (1914). 40 pp. With 8 Illustrations. Price 6d.

TUBERCULOSIS AS REGARDS HEREDITY IN CAUSATION AND ELIMINATION FROM INFECTED HERDS. By Professor SIR JOHN MCFADYEAN, M.R., B.Sc., C.M. (1911). 16 pp. Price 1s.

CALF REARING. An Experiment conducted at the Woburn Experimental Farm, 1913-14. By J. AUGUSTUS VOELCKER, M.A., B.Sc., Ph.D. 1915. 12 pp. Price 6d., 3d. to Members.

PAMPHLETS BY MR. CHARLES WHITEHEAD, F.L.S., F.G.S.:

PRACTICAL HINTS ON FRUIT FARMING. (1904). With 10 Illustrations. 43 pp. Price 1s.

HOP CULTIVATION. With 13 Illustrations (1903). 48 pp. Price 1s.

DAIRY PAMPHLETS:

(Issued under the authority of the Dairy Committee of the Society.)

THE PRACTICE OF (a) CHEDDAR, (b) CHESHIRE, & (c) STILTON CHEESE-MAKING. Price 2d. each.

SIMPLE RULES FOR BUTTER-MAKING. (Sheet.) Price 1d. each, or 5s. per 100. Mounted on card and varnished, to hang up in the Dairy, 6d. each.

RECIPES FOR MAKING CREAM AND SOFT CHEESES. Price 1d.

RECIPE FOR MAKING SCALDED CREAM. Price 1d.

MILK ADULTERATION. Price 1d.; 5s. per 100.

OTHER PAMPHLETS:

COMPENSATION FOR THE UNEXHAUSTED MANURIAL VALUES OF FEEDING STUFFS AND FERTILISERS. By J. AUGUSTUS VOELCKER, M.A., B.Sc., Ph.D., and A. D. HALL, M.A. (1911). 16 pp. Price 1s.

PRACTICAL HINTS ON VEGETABLE FARMING. By JAMES UDALE (1904). With 15 Illustrations. 41 pp. Price 1s.

THE WOBURN EXPERIMENTAL STATION OF THE ROYAL AGRICULTURAL SOCIETY OF ENGLAND. By J. AUGUSTUS VOELCKER, M.A., B.Sc., Ph.D. Annual Reports on Field, Feeding, and Pot-culture Experiments (1899-1917). Price 1s. each.

REPORT ON THE WOBURN POT-CULTURE STATION. By J. AUGUSTUS VOELCKER, M.A., B.Sc., Ph.D. With 17 Illustrations (1906). 52 pp. Price 2s. 6d.

THE MAKING OF THE LAND IN ENGLAND. By ALBERT PELL. (1899). 27 pp. Price 6d.

THE MANAGEMENT AND PLANTING OF BRITISH WOODLANDS. By Professor CHARLES E. CURTIS, F.S.I. (1904). With 6 Illustrations. 36 pp. Price 1s.

THE CONVERSION OF HOME-GROWN TIMBER. By ROBERT ANDERSON, F.S.I. (1904). With 4 Illustrations. 28 pp. Price 1s.

INSECTS INJURIOUS TO FOREST TREES. By CECIL WARBURTON, M.A., F.Z.S. (1904). With 7 Illustrations. 16 pp. Price 1s.

ORCHARD AND BUSH-FRUIT PESTS AND HOW TO COMBAT THEM. By CECIL WARBURTON, M.A., F.Z.S. With 12 Illustrations. Second Edition (1910). 20 pp. Price 6d.

THE DRYING OF FRUIT AND VEGETABLES. By J. AUGUSTUS VOELCKER, M.A., B.Sc., Ph.D. With 4 Illustrations (1917). 23 pp. Price 2d.

COTTAGE SANITATION IN RURAL DISTRICTS. By H. MACLEAN WILSON, M.D., B.Sc. With a Preface by T. PRIDGIN TEALE, F.R.S. Second and Enlarged Edition. 32 pp. 12 Illustrations (1914). Price 1s. per copy; 2s. per doz.; 12s. 6d. per 100.

The above can be obtained at the Society's House, 16 Bedford Square, London, W.C.1., through any bookseller, or of Mr. JOHN MURRAY, 50a Albemarle Street, W.1.

Copies of pamphlets sold at and less than One Shilling each are obtainable by Members of the Society at half price on direct application to the Secretary.

COLOURED DIAGRAMS.

(Obtainable from Messrs. W. & A. K. Johnston, Ltd., Edina Works, Easter Road, Edinburgh.)

TWENTY-SIX DIAGRAMS OF INJURIOUS INSECTS. Drawn from Nature by the late Miss ORMEROD, F.R.Met.Soc. Arranged in Five Sets, comprising (1) Common Insect Attacks; (2) Insects affecting Corn Crops and Grass; (3) Insects affecting Fruit Crops; (4) Insects affecting Hops and Gardens; (5) Insects affecting Trees. Also reproduced and mounted on canvas, with rollers.

EIGHT DIAGRAMS REPRESENTING THE LIFE-HISTORY OF THE WHEAT PLANT (after FRANCIS ELTON). With Explanatory Pamphlet by W. CARRUTHERS, F.R.S.

THE POTATO DISEASE. By W. CARRUTHERS, F.R.S.

TENTH EDITION

(FIFTY-FIRST THOUSAND)

OF

Elements of Agriculture

A TEXT-BOOK

PREPARED UNDER THE AUTHORITY OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

By W. FREAM, LL.D.

REVISED AND ENLARGED EDITION,

EDITED BY

J. R. AINSWORTH-DAVIS, M.A. (Trin. Coll., Camb.),

Principal of the Royal Agricultural College, Cirencester, and Professor of Natural History in the University of Bristol.

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(*Signature*) .....

Date .....

Nominated by .....

Elected at the Council Meeting held on .....

.....*Secretary.*

† The Council trust that all Members who are disposed to give a larger annual Subscription than the minimum of £1 prescribed by the By-laws will be kind enough to do so, in order that the Society's operations may be maintained.

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Every Member is entitled to receive, without charge, a copy of the Journal of the Society, each Volume of which contains articles and communications by leading authorities on the most important agricultural questions of the day, together with official reports by the Society's Scientific Advisers and on the various departments of the Show, and other interesting features. Copies of the Society's pamphlets, sold at not less than One Shilling each, are obtainable by Members at half price on direct application to the Secretary.

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The Society makes annually a considerable grant from its general funds in order that Members may obtain at low rates analyses of feeding stuffs, fertilisers, soils, &c., by the Society's Consulting Chemist (Dr. J. AUGUSTUS VOELCKER, Analytical Laboratory, 1 Tudor Street, London, E.C.4). Members may consult Dr. VOELCKER personally or by letter at a small fee.

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The Annual General Meeting of Governors and Members is held in London in the month of December, during the week of the Smithfield Club Cattle Show. A Meeting is also held in the Society's Showyard in the summer.

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The Annual Subscription of a Member is payable in advance on the 1st January of each year. Every candidate for admission into the Society must be proposed in writing by an existing Member. Forms of proposal may be obtained on application to the Secretary, at 16 Bedford Square, London, W.C.1.

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In addition to the privileges of Members, as described above, Governors are entitled to an extra copy of each Volume of the Journal, to attend and speak at all meetings of the Council, and are alone eligible for election as President, Trustee, and Vice-President. A Governor also receives a Silver Gilt Badge admitting him to the Show and to the Council and Governors' Rooms. The minimum Annual Subscription of a Governor is £5, with a Life Composition of £80.

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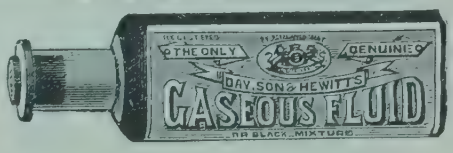
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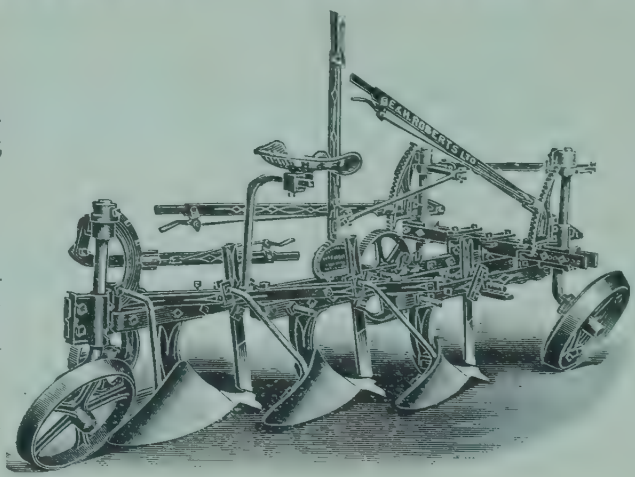
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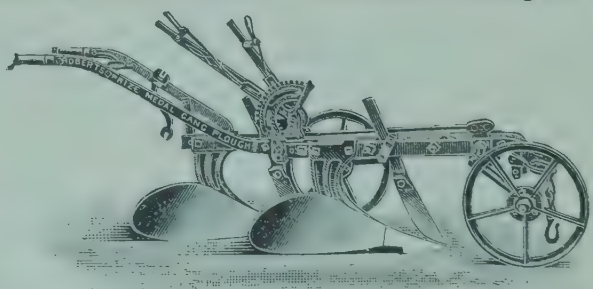


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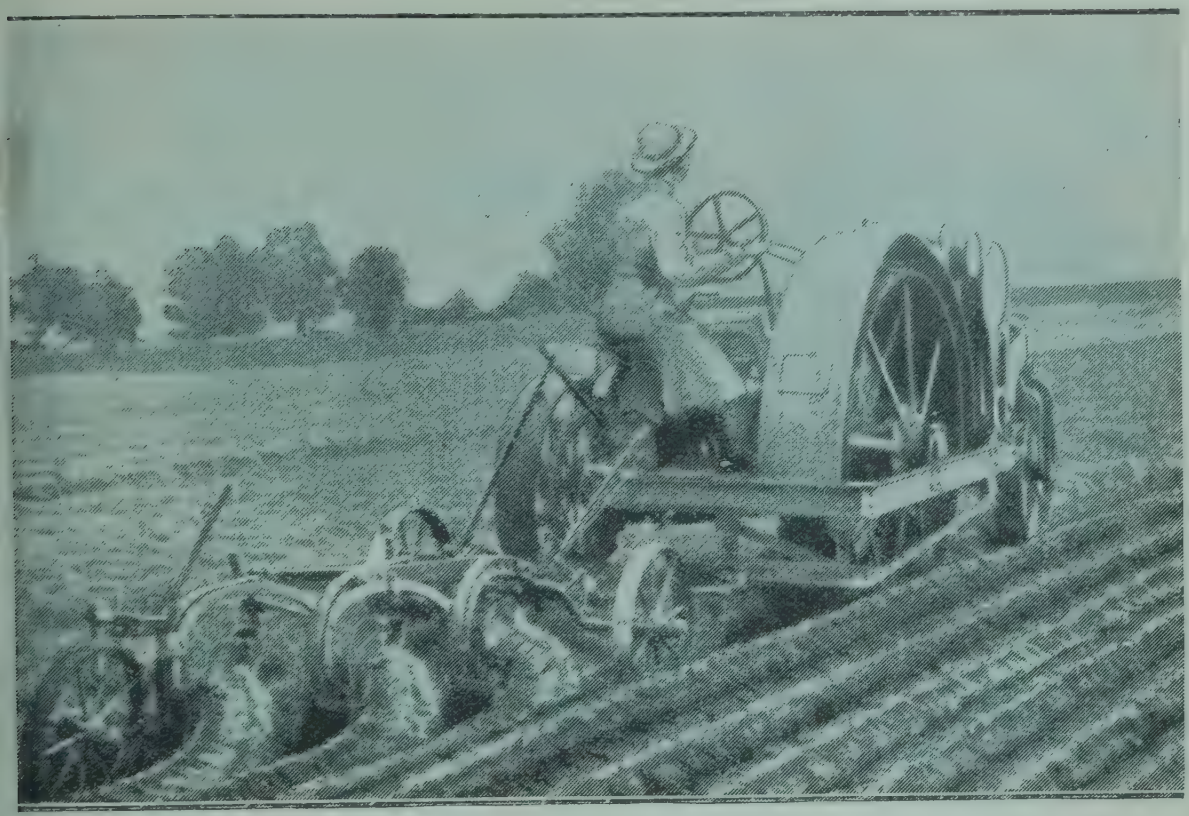
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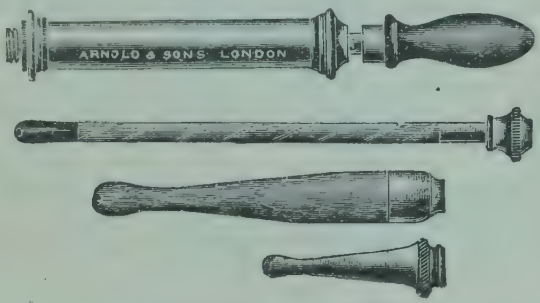


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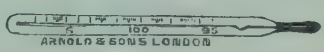
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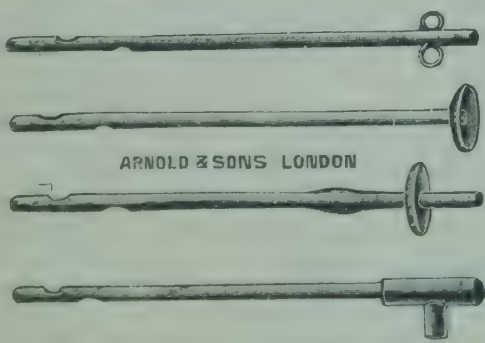
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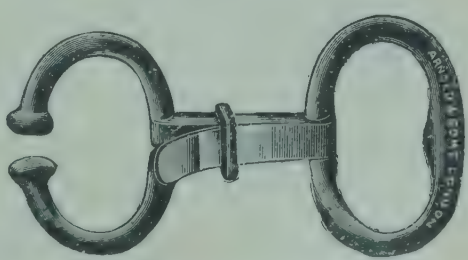
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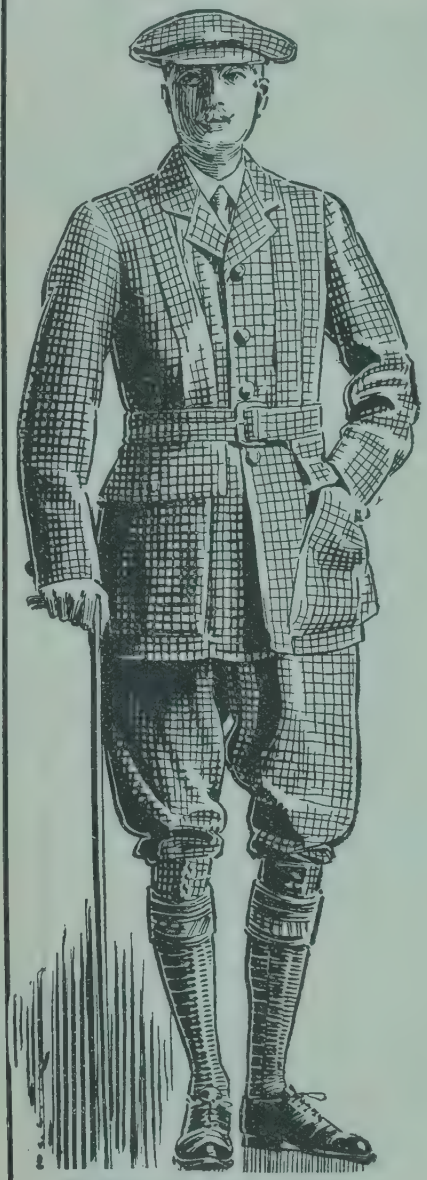
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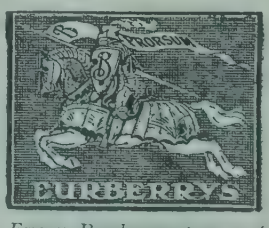
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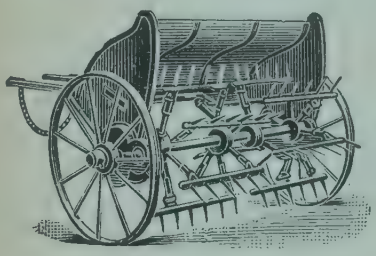
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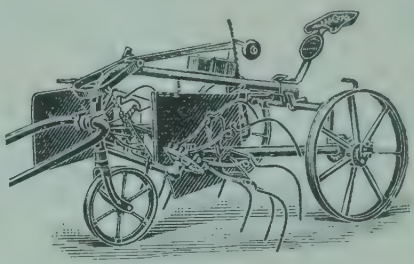
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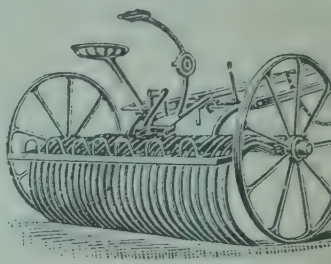
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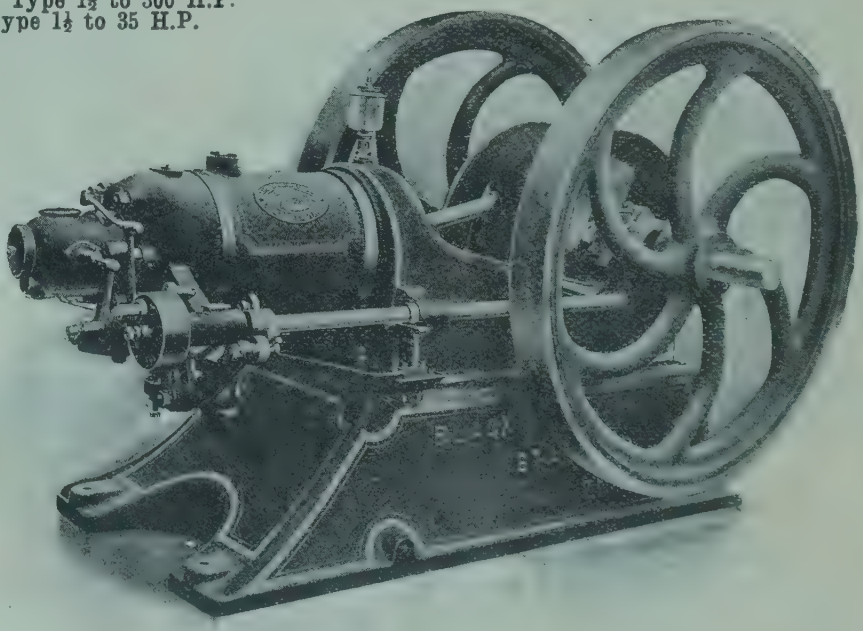
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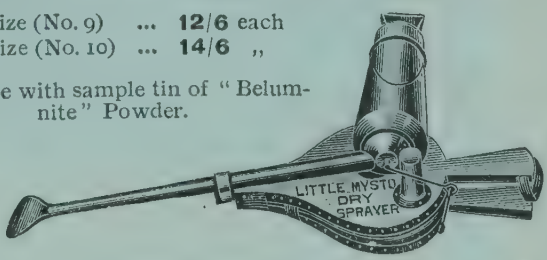
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Photo by G. H. Parsons.

THEALE LOCKINGE 34246.

THEALE LOCKINGE 34246. Bay, foaled 1916. Sire, Norbury Menestrel 23453; dam, 61016 Lockinge F Lockinge Sweet William 20654; g. dam, 51557 Lockinge Rosalind by Lockinge Forester; g. g. dan Barberry Queen by Prince Harold 14223; g. g. g. dam, 10274 Lady Lockington by Premier 2646; g. dam, 3832 Black Diamond by John Bull 5139. Won Prizes: 1st Hereford and Worcester; 1st Dor 1916; 1st and Reserve Junior Champion Shire Horse Show, Newmarket, 1918.

CHAMPION'S CHANCELLOR 33095. Bay, foaled 1914. Sire, Childwick Champion 22215; dam, 55974 Barr by Lockinge Forest King 18867. Won two 1st Prizes and Reserve for Cup, Welbeck, 1914, only time Let to the Bridgwater Shire Horse Society, 1918 and 1919.

THEALE CHAMPION 31879. Brown, foaled 1912. Sire, Mimms Champion 26462; dam, 58565 Theale Q Present King II. 18848. Won 1st Newbury, 1st South Berks, 1st East Berks, and 2nd Guildford, 191 Shire Horse Show, and 2nd Gloucestershire, 1914.

THEALE MENESTREL 34380. Bay, foaled 1915. Sire, Norbury Menestrel 23453: dam, 70049 Bunny Queen by Bardon Ruler 23975.

THEALE ROYAL BLEND 35247. Brown, foaled 1916. Sire, Glen Royal II. 21466; dam, 78486 Kirtling At by Shelford Enterprise 22780. Glen Royal II. was 1st in London, 1908.

THEALE CARDINAL 35243. Brown, foaled 1916. Sire, Blaisdon Draughtsman 32113; 2nd in London 191 London 1917; dam, 76207 Theale Nightshade (own sister to Garston Surprise) by Mimms Champion

THEALE ST. CLAIR 35248. Brown, foaled 1916. Sire, Theale Champion 31879; dam, 42214 Hilmarton Pa Cricklade Willow 20394.

THEALE ELCOMBE 35244. Bay, foaled 1916. Sire, Theale Champion 31879; dam, 57277 Hilmarton Ven Coleshill Monarch 23176. Hilmarton Venture is own sister to 82675 Queenie, 2nd in Lond on 1916 an

THEALE CONQUEROR Vol. 40. Brown, foaled 1916. Sire, Bridge Sollars Conqueror 27125; dam, 49190 Rosine by Birdsall Calamint 17766.

THEALE CHANCELLOR Vol. 40. Bay, foaled 1917. Sire, Champion's Chancellor 33095; dam, 50203 B Blagdon by Exton Duke 21411.

THEALE FRIAR Vol. 40. Bay, foaled 1917. Sire, Champion's Chancellor 33095; dam, 66302 Bunney Duc Tatton Friar 21953.

GARTHMYL BRIGADIER Vol. 40. Bay, foaled 1917. Sire, Halstead Blue Blood 27307; dam, 61041 R Dazzle by Childwick Champion 22215.

THEALE BLUE BLOOD Vol. 40. Bay, foaled 1917. Sire, Abbots Royal Blood 31147; dam, 83213 Surprise by Champion's Clansman 29221.

THEALE MARS Vol. 40. Brown, foaled 1917. Sire, Blaisdon Jupitor II. 31207; dam, 70201 Preston Prin King Cole VII. 26351.

N.B.—The above are for Service, Hire, or Sale. Mares and Fillies of the best breeding always on

Crosshill Shire Stud

Property of E. GOODWIN PREECE, Crosshill, Shrewsbury.

Comprises **MARES, FILLIES AND COLTS** by the following Sires:—

Dukes Double.	**Eaton Nunsuch.**	**King of Tandridge.**
Babingley Nulli Secundus.	**Champion's Governor.**	**Danesfield Stonewall.**
Childwick Champion.	**Marden Forest King.**	**Folville Bendigo.**
Norbury Coronation.	**Gaer Conqueror.**	**Headley Royal.**
	Bardon Royal Albert.	

Among the Mares and Fillies are several well-known prize-winners, and as most of them are at daily work upon the farms, they are good workers and in natural healthy condition.

COLTS, MARES and FILLIES for Sale.

Lea Dairy Shorthorn Herd

Comprises **80 Pedigree and Non-Pedigree Cows and Heifers.** All directly descended through their sires and grand-sires for four generations from **1,000-Gallon Cows on both sides.**

Established in 1902 with four Heifers and a Bull from Lord Rothschild, which were of the best milking strains in the famous Tring Herd; one of the heifers being a daughter of the noted Darlington Cranford 5th, and another from Darlington Cranford 3rd. Additions have since been made from the herds of the late Mr. Geo. Taylor (Cranford) Mrs. Thornton (Kingsthorpe), and Mr. Saml. Sanday (Puddington), and special care has been taken to use only bulls from dams of the very highest milking records on both sides, the last six used being:—

(1) **Imperial Furbelow 120805,** red, bred by Mr. W. N. Pilkington. Sire, Tamini 104144 (out of Melody, which gave 1232 gallons milk in 1906, and won 1st Milking Trials R.A.S.E., 1st Milking Trials, Gold and Silver Medals, and Challenge Cup, London Dairy Show 1905, &c.). Dam, Furbelow Princess 5th (which averaged 956¼ gallons for four years ending Sept. 30, 1914). Grand-dam, Furbelow Princess, which averaged 959 gallons for three years ending Sept. 30, 1912.

(2) **Waterloo King 97628,** red, bred by the late Mr. G. Taylor, and for some years used in the Cranford herd. Sire, Beau Sabreur 74049; dam, Waterloo Rose 2nd, gave 1184 gallons of milk in 1905. Beau Sabreur's dam was a great milker and prize-winner.

(3) **Kelmscotonian 39th 95608,** red, bred by Messrs. Hobbs, Kelmscott. Sire, Red Waterloo 6th 82034 out of Lady Somerset Waterloo, which gave 1102 gallons in 1902; dam, Lovely 37th, 1st prize London Dairy Show 1905. Average, 1026 gallons per annum.

(4) **Darnley 80847,** red, little white, bred by Lord Rothschild. Sire, Magna Charta 77166 (out of Moppy Gem 2nd; average 3 years, over 995 gallons per annum); dam, Darlington Cranford 5th, 2nd London Dairy Show, &c., and averaged over 1009 gallons per annum for five years.

(5) **Reformation 109883,** white, bred at Cranford, by Mr. G. Taylor. Sire, Stadborough Cran 101403 out of Darlington Cran by Beau Sabreur. She won many prizes and was from the same family as the noted Darlington Cranford 5th. Darlington Cran was sold by auction in 1909 for 190 guineas. She gave 1187 gallons of milk during the year ending October, 1910, and was dam of Red Rose A, which gave 1196 gallons year ending January, 1911, and was sold for 100 guineas at Cranford Sale, 1911.

(6) **Rattler 89755,** red, bred by Lord Rothschild. Sire, Magna Charta (as above); dam, Lady Rosedale, which averaged over 924 gallons per annum for six years.

The herd is kept in a natural state. Several heifers and bulls have been sold for export.

Young Bulls, Bull Calves, Heifers, and Cows for Sale.

FOR FURTHER PARTICULARS APPLY TO THE OWNER:—

E. GOODWIN PREECE, Crosshill, near Shrewsbury.

Station: Shrewsbury (1½ miles). Telegrams: "Cattle, Shrewsbury." Telephone: No. 207.

Eaton Shire Stud, Herds and Flocks.

The Property of HIS GRACE THE DUKE OF WESTMINSTER.



MONKHILL BUTTERFLY. Vol. 58. First, Royal Lancashire.



ROB ROY'S RULER, 35136. Sire Halstead Rob Roy 29449.
At Home Season 1919.

LARGE NUMBERS OF ALL ABOVE BREEDS FOR HIRE AND SALE.

Application to view by appointment.

Telegrams: CROWE, ALDFORD. **JOHN CROWE, Aldford, Chester.** Telephone: ALDFORD 3.

Stations: Chester (L.N.W. Ry. and G.W. Ry.), 5 miles; Waverton (L.N.W. Ry.), 3 miles.

LOOBAGH HERD

OF PEDIGREE

DAIRY SHORTHORNS

THE PROPERTY OF

SIR GILBERT GREENALL, Bart., C.V.O.,
Mount Coote, Kilmallock, Co. Limerick.

This Herd was established in 1912 by the purchase of the BEST SPECIMENS from the late Mr. George Taylor's Herd at Cranford, and other noted Dairy Shorthorn Breeders during the last six years.

. The Herd is now composed of .
OVER 100 of the FINEST DAIRY CATTLE IN THE BRITISH ISLES.

DAILY MILK RECORDS KEPT

which are regularly inspected by the Department of Agriculture's and Dairy Shorthorn Association's Inspectors.

WEEKLY BUTTER-FAT TESTS RECORDED.

All the Cattle are kept under NATURAL CONDITIONS and whilst living on the noted milk-producing land of the County Limerick it is unnecessary to force them in any way.

THE CATTLE ARE SUBMITTED TO THE TUBERCULIN TEST TWICE YEARLY.

Young Bulls and Heifers for Sale.

INSPECTION INVITED.

Kilmallock is on the main line from Dublin to Cork, and is reached in under 14 hours from London, and 3½ from Dublin.

Apply: HENRY M. FILDES,
ESTATE OFFICE, MOUNT COOTE, CO. LIMERICK.

MANSEL COURT HEREFORD HERD

. . OWNER . .

Capt. Ralph T. Hinckes,

MANSEL COURT, HEREFORD.



STARLIGHT 28754.

Sire and Grandsire of highest priced Herefords ever sold in the World, including :—Ringer (£9,450) ; Resolute (£8,400) ; Mansel Handyman (£4,725) ; One Royal (£3,500) ; Twyford Ringer (£2,205) ; Mansel Leader (£1,575).

Prizes for best group of three Bulls H.H.B.S. Show and Sale, 1918, won by Mansel Court Herd.

Stock Bulls :

STARLIGHT 28754 **MANSEL RIGHTFUL 35289**

TELEGRAMS : HINCKES, HEREFORD.

PEDIGREE LIVE STOCK

The Property of Messrs. CHIVERS & SONS, Ltd.

Large White Pigs.

Over 1,000 Large White Pigs are bred annually. The Herd is composed of animals of the best strains and has been very successful in the Show Ring. A large selection of Young Boars and Gilts always on hand.



HISTON NORTH LASS.—A winning Gilt at the R.A.S.E. Show at Manchester, 1916.

Dairy Shorthorns.

The Herd numbers over 150 Head, and is largely composed of representatives of the best Bates families. Daily Milk Records kept. Young Bulls from Heavy Milking Dams for Sale.



Stock Bull: ROYAL FOGGATHORPE 133300.

Dam: **Elsie Foggathorpe,** 1st, Royal Dublin Show, 1915, and gave 11,724 lb. of milk in 310 days.

Sire: **Salmon's Favourite 117594,** whose dam, Fedora by Beau Sabreur 74049, gave 742 gallons of milk with her first calf.

Apply Estate Department, CHIVERS & SONS, Ltd., Histon, Cambridge.

Eaglesfield Herd, Pedigree Dairy Shortho

The Property of **G. P. GOLDEN, Leire, Lutterworth, LEICESTERSHI**

Station : BROUGHTON ASTLEY, M.R.

Lady Clara won 1st Prize London Dairy Show, 1913, in a class (over 40) generally admitted to be the finest collection of dairy cows ever seen. Also 1st Prize and Champion, Preston, and 1st Prize, Liverpool. Due to calve, 8th January, to Gilmorton Lad 131183 out of 1,200 gallon cow).

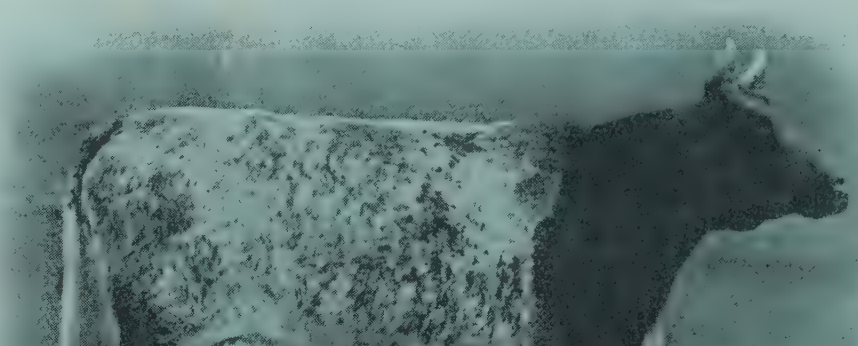


Photo by G. H. Parsons.

LADY CLARA.

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GROUP COWS.

Breeders :
Late Lord Rothschild (3).
R. W. Hobbs & Sons (1).
G. Taylor (1).

BABRAHAM RAIN

1st Prize, Royal Co
Show, 1914.

DAILY MILK RECORDS KEPT



AND CHECKED THE DAIRY SHORT ASSOCIATION.

PEARL MAIDEN (as in-calf heifer).

Breeder, late Lord Rothschild. Sire, Foundation Stone (sire 950 and 650 gn. heifers, and grandsire 800 gn. h sold this year); dam, 6-gallon cow.

This herd was founded by purchase of heifers direct from the late Lord Rothschild's famous herd at Tring Messrs. R. W. Hobbs & Sons at Kelmscott, and is now composed almost entirely of these strains. Some fine specim Tring out of cows having perfect udders and heavy milkers of the best prize-winning ancestry are included in the **DORCAS** (by Conjuror), dam of Doreen, sold for 230 guineas at Wrest Park, winner of 2nd Prize Oxfordshire, 2nd West, and 3rd Royal Show, Shrewsbury, 1914. **LADY BUTTERFLY,** sire Foundation Stone out of Lady Bownes ful Tring Park cow, and winner of many prizes, including three firsts. **PEARL MAIDEN,** by Foundation Stone o Queen, a six-gallon cow possessing a rare udder. **SUNSHADE 9th,** a rare cow, by Dreadnought (entered and co sure winner but prevented from being shown, Royal Show, Shrewsbury). **CHEERFUL,** by Conjuror, out of Cher 2nd Oxfordshire, and Bath & West, and H.C. Royal. Cheerful was purchased for 100 guineas as a heifer at the Tring

YOUNG BULLS AND HEIFERS FOR SALE, chiefly by **GILMORTON LAD 131183** (J. W. Sanders), dam Lass, that gave 10,085 lb. milk from 1st October, 1914, to 30th September, 1915, and 12,785½ lb. with her third 1st October, 1915, to 30th September, 1916. D.S.A. Book : sire Lawrenny Foggathorpe (out of Flora Foggathorpe

THE DOWNE GUERNSEY HERD

. . THE PROPERTY OF . .

D. C. HALDEMAN, Esq., J.P., The Rookery, Downe, Orpington, Kent.



DOWNE ROMANA 1st 9981.
(Certificate from Society.)
DETAILS OF RECORD.

Age at commencement: 2 years, 3 months, 6 days.
Milk produced, 7,428 lb. (qualification for entry, 6,350·40 lb.).
Butter Fat produced, 414·49 lb. (qualification for entry, 260·82 lb.).
Average per cent. of Butter Fat, 5·58. Number of weeks in milk, 48.

The first consideration of the Downe Guernsey Herd is Health. The animals are kept under the most healthy and sanitary conditions, and are periodically tested for tuberculosis. The Guernsey is a hardy cow and should not be coddled.

The second consideration is Milk. Milk records are strictly kept. The Herd has been built up from the very best milking strains procurable, and has taken a prominent place in the E.G.C.S. Milk Records, taking the top place two years in succession, in addition to being well represented in the other classes.

The following are a few examples of what some of the cows have done:—

SHAMROCK in six years gave 52,382 lb. of milk and 2,536 lb. of butter fat.
HONEYMOON in three years gave 33,787 lb. of milk and 1,692 lb. of butter fat.
MARY'S record is so remarkable that it should be set out in full:—

	Milk.	Butter fat.	Percentage of butter fat.
With her first Calf she gave ...	7,830·75 lb. ...	424·42 lb. ...	5·42
,, second ,, ...	8,925·25 ,, ...	528·09 ,, ...	5·93
,, third ,, ...	10,025·00 ,, ...	596·48 ,, ...	5·95

KATE gave 10,100 lb. of milk and 567·62 lb. of butter fat.
SUSAN gave 10,428·50 lb. of milk and 527·68 lb. of butter fat.
ROSE has gained the E.G.C.S. Milk Record Certificate three years in succession. With her first calf she gave 8,453 lb. of milk and 380·38 lb. of butter fat (amount required to qualify, 6,127 lb. of milk and 254 lb. of butter fat).

This is enough to substantiate the claim that the Herd has been built up from the best milking strains procurable.

The third consideration is Inspection. That the Herd includes thoroughly typical specimens of the breed can be demonstrated by a visit to the Home Farm.

The Herd can be seen by appointment on application to the Bailiff:

L. G. POWELL, The Rookery Home Farm, Downe, Orpington, Kent.

STATION: ORPINGTON. 'PHONE: 1812 BROMLEY.

THE NOTLAW SHORTHORN HERD.

THE PROPERTY OF

Dr. VAUGHAN HARLEY, Walton Hall, Bletchley, Bucks.



NOTLAW DARNLEY 138271.

Sire, Notlaw Bonaparte 121824.
Dam, Notlaw Dorothy 6th by Notlaw Duke 106402.

First Prize, Champion, and Maclennan Cup, Birmingham, 1918. Sol for 1,600 gns. and resold at large price in Argentine.



Photos by G. H. Parsons.

NOTLAW NIMROD 138277.

Sire, Notlaw Bonaparte 121824.
Dam, Notlaw Nonpareil 16th by Gartly Landlord 815511.

First Prize and Reserve Champion and Reserve Maclennan Cup, 191 Sold for 2,000 gs. and resold for 50,000 dollars, highest price at Publ Auction in Argentine.

The Herd includes the best Scotch Pedigrees and Cattle kept in natural condition.

SHIRE HORSES. Stud Horse LANGWITH COMMANDER 34805.
Sire, Royal Commander 30815 by Childwick Champion 22215.
Dam, Shirebrook Flash by Scarcliffe Manners 22763.

OXFORD DOWN SHEEP. RAM BREEDING FLOCK No. 177.

ıe Underley Herd of Pure-Bred Dairy Shorthorns ınd Flock of Wensleydale Blue-Faced Sheep.

The Property of LADY HENRY BENTINCK, Kirkby Lonsdale, Westmorland.



YELDERSLEY BEAU.

Herd of Dairy Shorthorns, rich in prize-winning blood. Special attention devoted to milking properties (both tity and quality) combined with aptitude to fatten when dry. Milk records kept under Dairy Shorthorn ıation and Board of Agriculture inspection, and light milkers drafted out. The herd includes numerous sentatives of the famous North-country dual-purpose Shorthorns which are meeting with such a great demand present day, as also cows and heifers of the best Bates and Cranford families.

OCK BULLS.

Yeldersley Darlington Premier 123740. Bred by Capt. H. FitzHerbert Wright, M.P.; sire, Roseberry 0, dam, Darlington Cranford 68th (winner of Second Prize at the Hereford and Worcester Show, 1916, and gave 9,211 lb. of milk with her first calf).

Yeldersley Beau. Bred by Capt. H. FitzHerbert Wright, M.P. The best bull at the Yeldersley Sale 1917. ought for 300 guineas; sire, Darlington Minor 119807 (First at Royal Show, 1914), dam, Thorndale Belle 20th nd at the Gloucestershire Show, and Second at the Hereford and Worcester Show, 1914).

WENSLEYDALE SHEEP.



Photos by G. H. Parsons.

Shearling Ram SLYNE MINISTER.

[illegible] Flock in the country. Successfully exhibited at all the leading shows. 955 Prizes [illegible] years. At the last Royal Show prizes won include: First and Second for aged rams; First and [illegible] for pens of three shearling ewes; First and Reserve for pens of three shearling rams; and Second and [illegible] for single shearling rams. The breed provides the best of mutton and long lustre wool, and crosses well [illegible] others, both at home and abroad, and in particular for the production of early fat lambs and stores which no breed can equal.

RAIL STATIONS: Barbon (2 miles) and Kirkby Lonsdale (2½ miles, whence 'bus to town) on Ingleton Branch of L. & N.W.R.; Arkholme (6 miles) on Carnforth to Wennington Branch of Midland Railway; and Burton and Holme (7 miles) or Carnforth (11 miles) on Main Line of L. & N.W.R.

THE HEAN CASTLE SHORTHORN HERD.

THE PROPERTY OF

LORD MERTHYR, Hean Castle, Saundersfoot

PEMBROKESHIRE.



Photo by] [*Sports and General.*

Pedigree Shorthorns of the

AUGUSTA, BEAUTY, BRAWITH BUD, BROADHOOKS
BUTTERFLY, CLIPPER, LAVENDER, MISSIE, ORANG
BLOSSOM, PRINCESS ROYAL, and SECRET Families.

STOCK BULLS:

COLLYNIE CHANCELLOR 119543
HEAN GOLDFINDER 137017 and
EDGCOTE ROYALIST [VOL. 65].

LYNHALES HEREFORDS

The Property of Major STEWART ROBINSON.

The Choicest Breeding Lines obtainable.



ONE ROYAL (32871).
Sold for £3,500 for export to U.S.A. Record price for an exported Hereford.



Photos by G. H. Parsons.

RESOLUTE (35537).
Sold for £8,400, the record sum for a yearling Hereford Bull.

Sires used in the Herd during the last six years :—

GAINSBOROUGH (28303).—Champion at the Royal Show, 1915.
RINGER (31920).—First Prize, Royal, 1915, and sold for the record price of £9,450.
ONE ROYAL (32871).—Sold for £3,500.
RESOLUTE (35537).—Sold for £8,400.

Apply **Major STEWART ROBINSON, The Ovals, Kington, Herefordshire.**

Kingsthorpe Hall PEDIGREE DAIRY Shorthorn Herd

The Property of F. H. THORNTON, Esq., Kingsthorpe Hall, Northampton



Photos by G. H. Parsons.

DAIRYMAID VI.

Dam of Kingsthorpe Forester, one of the Stock Bulls in the herd.
Milk Record, from November 13th, 1917, to September 30th, 1918 (320 days), 12,084¾ lb.



WALNUT STELLA XI.
Gave in 280 days 10,027½ lb. milk.



KINGSTHORPE FORESTER
Dam, Dairymaid VI. (see above). Age 12 m

This first-class herd was established eighteen years ago, and contains some grand animals of best old Bates families—Barringtons, Blanches, Darlingtons, Rubies, Wild Eyes, and Knightley Walnuts also some of the best Cumberland and Westmorland families.

The object has been to produce dual-purpose animals; and the cows, besides being good milkers are evenly fleshed, with good constitutions and fine Bates character.

Dairy milk records and butter-fat tests have been regularly taken, the quality of milk being a speciality. Records checked by Board of Agriculture and D.S.A. Inspectors.

The Bulls used have been from dams with high butter-fat records.

KINGSTHORPE REGENT, now in service, is descended on both sides from 1,000 gallon cows. His dam, Somerford Flower 2nd, has taken over twenty first and champion prizes, and has yielded an average of 12,216 lbs. of milk for the last three years. Her average of butter-fat, when in full milk, giving 6½ gallons per day, was 4·2 per cent. in the morning and 4·8 per cent. in the evening

For particulars apply to **Mr. J. DOUGLAS, Home Farm, Kingsthorpe, Northampton.**
Northampton Station one mile.

Telegrams: "Thornton Kingsthorpe." *Telephone: 681 Northampton.*

PEDIGREE DAIRY SHORTHORNS

THE PROPERTY OF

Capt. ARNOLD S. WILLS, Thornby Hall, Northampton.



DOLPHINLEE PRIMROSE.

Dam of Thornby Pioneer, sold on June 21st, 1918, at the Home Sale to Sir Gilbert Greenall for 2,000 gns. She is also the Dam of Thornby Pioneer used in the Herd for the last three years.



THORNBY PREMIER.

Sire, Drusus; dam, Dolphinlee Primrose, sold to Sir Gilbert Greenall for 2,000 gns.

Dolphinlee Primrose won first prize Royal Lancashire Show, 1915, and gave 10,238½ lb. of milk with her first calf, and 9,225½ lb. with her second; unfortunately fell with gargel with her third, has lost two quarters.



THORNBY PIONEER 133922.

Sire Drusus 115142; dam, Dolphinlee Primrose, used in the Herd for the last three years.



THORNBY LADY YORK 2nd.

Born May 6th, 1916; sire, Drusus; calved, October 31st, 1918, under 2½ years of age, and has given from November 3rd, 1918, to April 26th, 1919, 6,450½ lb. and is still giving 26 lb. daily with her first calf. She is again due to calve on Sept. 14th, 1919. Drusus' dam, Dorothy, gave an average of 10,536 lb. of milk for 11 years.

PEDIGREE GLOSTER OLD SPOTS PIGS. GILTS AND BOARS SOMETIMES FOR SALE.

FOR PARTICULARS APPLY: J. R. GOODMAN.

The Westacre Herd of Aberdeen-Angus Cattl

The Property of W. H. LEE, Westacre, Compton, Wolverhampton.



EVVIE 4th 56722.

Herd comprises the following families—**Erica, Pride of Aberdeen,** and **Jilt.**

Stock Bull: Earnest of Dalmeny 41173.

The Westacre Herd of Large Black Pigs.



On and after 25th March, 1919 these Herds will be known by the name "SHIPLEY," and th address will be –

W. H. LEE, Shipley Hall, Pattingham, WOLVERHAMPTON.

The Kelmscott Dairy Shorthorn Herd, Oxford Down Flock, and Stud of Shire Horses.

The Property of R. W. HOBBS & SONS, Kelmscott, Lechlade, Glos.

Herd 500 Dairy Shorthorns. Milk records kept. Numerous prizes won for Inspection, Milking, and in Butter Tests, including the Fifty Guinea Group Challenge Cup for the last three years at the Royal Show; and the Gold Medal, the Shorthorn Society's Prize, "Spencer" and "Shirley" Challenge Cups, three Firsts, three Second, and three Third Prizes at the London Dairy Shows.



Rose 44th. Bred at Kelmscott. Won 1st Milking, 2nd Inspection, the Shorthorn Society's Prize, Gold Medal, "Spencer" and "Shirley" Challenge Cups at the London Dairy Show, in 1914. She gave 15,505 lbs. of Milk in 318 days with her last calf.

STOCK BULLS in service from Dams with Milk Records above 1,000 Gallons include **Trickster 4th 118050,** dam Tricksey 16th (1st Prize Royal Dublin Show); **Kelmscott Juggler 116052,** dam Hawthorn 7th (Champion Royal Show); **Cranford Freemason,** dam Red Rose 3rd; **Cranford Wild Eyes 111416,** dam Wild Eyebright 9th; **Cranford Regulator,** dam Georgie Cran 2nd (2nd Prize Royal Lancashire Show); **Creme de Menthe,** dam Greenleaf 32nd (1st Milking, 2nd Inspection, 5th Butter Tests, London Dairy Show); and **Kelmscott Acrobat 4th,** dam Spotless 31st (1st and Reserve Champion Royal Show).

Bulls and Bull Calves always on Sale at moderate prices, and usually a few good three or four cross Non-pedigree Bull Calves, suitable for use in Non-pedigree dairy herds.

All Cows in milk and the Stock Bulls have passed the Tuberculin Tests.



Helpmate 11th. Bred by R. W. Hobbs & Sons. Won First Prize at the Royal Show, 1913, for the Best Dairy Cow of any breed or cross, and First Prize at the Royal Show, 1914, for Best Shorthorn Dairy Cow.



Lemhill 32nd. Bred by Messrs. Hobbs. Sire Cranford Freemason. At 5 years 11 months she has produced four grand Bull Calves, and 27,286 lb. of Milk, an average of 9,095 lb. with her first three Calves. She was a prize-winner at the Royal Show, 1915-16, and is the dam of the stock bull Kelmscott Dreadnought 8th.

OXFORD DOWN FLOCK.—A large flock of Ewes is kept. Shearling Rams, Ram Lambs, and Ewes have been successfully shown at leading shows for many years. Rams, Ram Lambs, and Ewes always on Sale.

KELMSCOTT STUD OF SHIRE HORSES.—Sound active Colts and Fillies of all ages on sale. Grand Stud Stallion, **King of the Roses,** purchased at Lord Rothschild's sale at Tring in 1908 for £672. Sire, Birdsall Menestrel (twice champion at the London Shire Horse Show). Dam, Eastwood Guesder Rose (champion mare at the Royal Show). Also the grand two-year-old Marden Hotspur, recently bought for 500 guineas. Sire, Marden Forest King, dam, Marden Phylis.

INSPECTION INVITED. ***Station: KELMSCOTT, 2 miles.***

Telegrams: HOBBS, LECHLADE.

RYELAND SHEEP

THE COMING BREED.

At the present day they are unsurpassed in the production of fine wool and delicious flavoured mutton, also for crossing purposes for the getting of Fat Lambs.



Photo by] [*Sport and General.*

Winners of 1st Prize and Medal for Fat Lambs, Smithfield Show, Dec., 1916. Also won 2nd Prize with another Pen.

Clytha Park Flock

Winners of many Prizes in previous years. Winners of **Four First Prizes** Herefordshire and Worcestershire Show, 1916, and **Two First Prizes, Four Second Prizes,** and **One** for **Wool** at Royal Show, Manchester, 1916. **First Prize** for Best Pen of Five Ewes at Hereford Ryeland Show and Sale, Aug., 1918.

1st and 2nd Prize and Medal for Fat Lambs, Smithfield Show, December 4th, 1916.

SHEARLING RAMS & RAM LAMBS, &c., FOR SALE.

Inspection by Appointment invited.

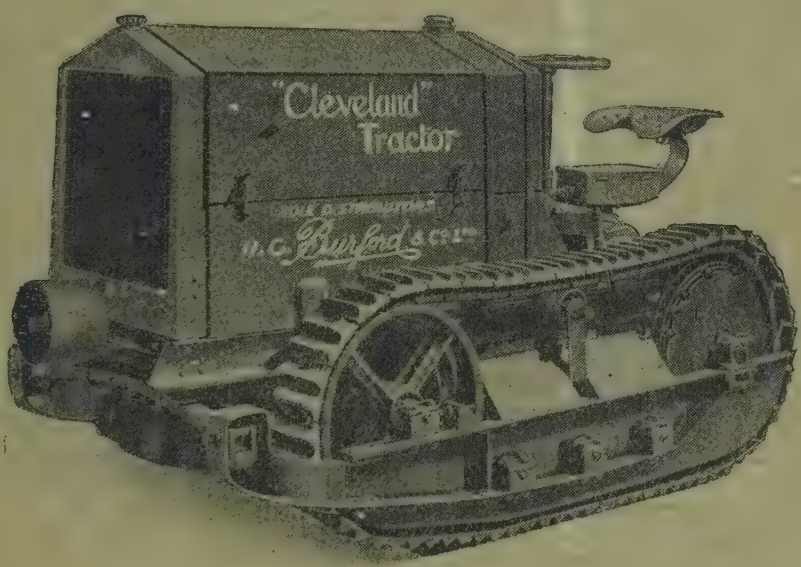
Apply, MANAGER, Clytha Park, Abergavenny.

"CLEVELAND"

TRACTOR

NEW MODEL.

Order Early and get Quick Delivery.



This Tractor will operate in light or heavy land.

Many hundreds are in daily use and giving complete satisfaction.

The "Cleveland" will plough at the rate of six acres per day at a small cost.

Write for Catalogue of "Victory" 3-Furrow 9 in. Plough.

H. G. BURFORD & CO., LIMITED,

HEAD OFFICE:

16, REGENT STREET, LONDON, S.W. 1.

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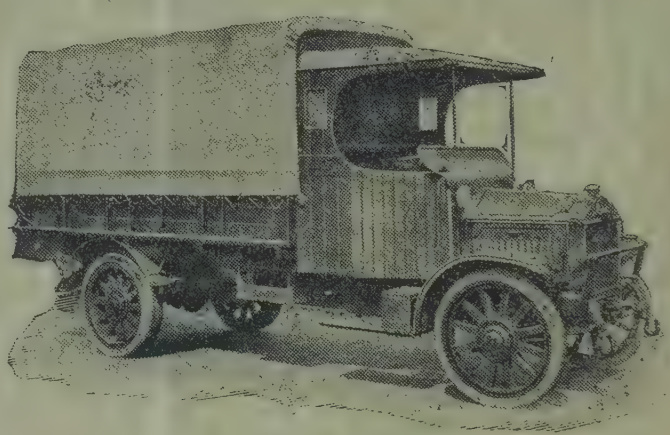
Burford LORRIES

REGD. TRADE MARK.

The popular 2-tonner is the best investment you can make to-day.

We can produce many testimonials testifying to the work done by these vehicles during the war.

The "Burford" is a light fast vehicle carrying two tons in addition to the weight of body.



Orders are executed in rotation as received.
Good delivery can be given if order placed at once.

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Telephone: Regent 5280 (2 lines). Telegrams: "Burfordism, London."

HEREFORD CATTLE

THE WORLD'S PREMIER BEEF BREED.



Photos by G. H. Parsons.

UNSURPASSED FOR

Early Maturity

Hardy Constitutions

Easy & Quick Feeding

Freedom from Tuberculosis

Ranching Purposes

THE MOST ECONOMICAL BEEF PRODUCERS IN EXISTENCE



TYPICAL HEREFORDS.

The Breed with the Brightest Prospects.

For all information apply to

W. G. C. BRITTEN,

Secretary,

THE HEREFORD HERD BOOK SOCIETY, HEREFORD, ENGLAND.

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DARLINGTON OF BRAE (Vol. 62, p. 1036).
Roan, calved March 3rd, 1915.

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Present Stock Bulls:

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(So successfully used by the late Lord Lucas).

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Donald (Vol. 64).

The Herd ranks as one of the best for beautiful cattle with great scale, strong constitution, and typical Shorthorn character, combined with dairy qualities of the highest order.

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31 Cows and Heifers, recorded in "Dairy Shorthorns Year Book for 1917," averaged 7,180 lb. milk.
37 " " " " " " 1918 " 7,255 lb. "

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Photos by G. H. Parsons.

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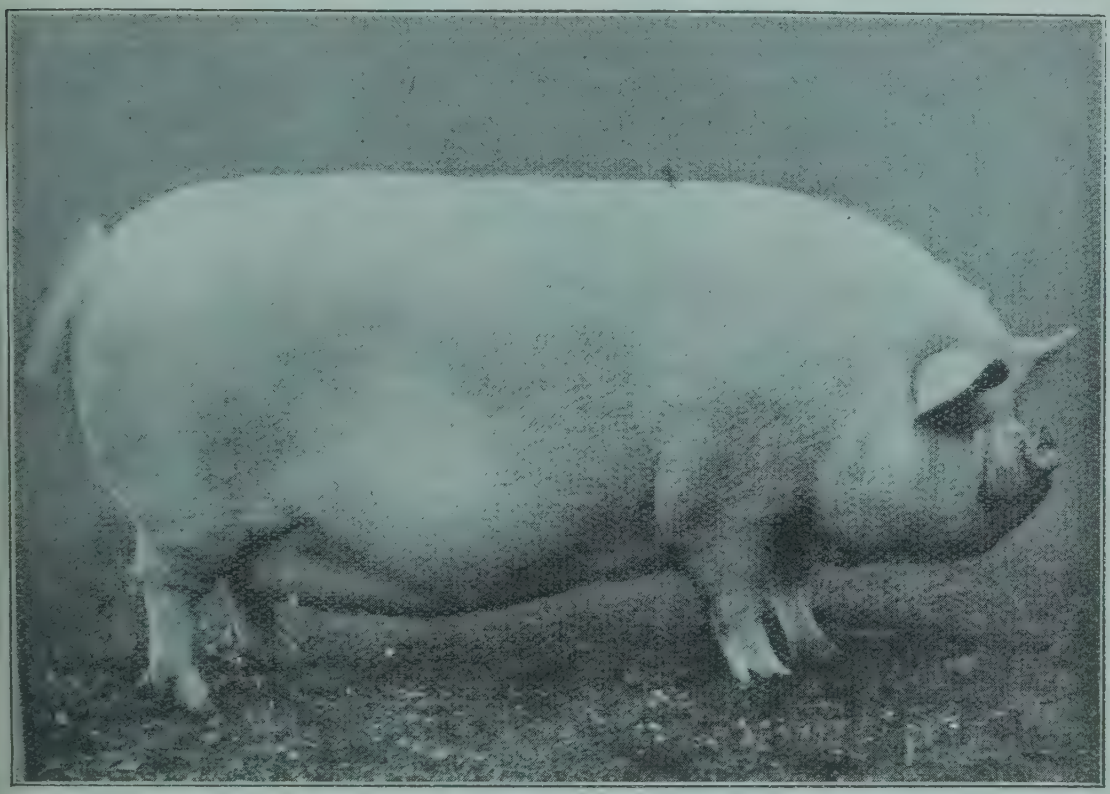
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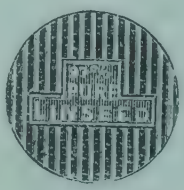
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CATTLE—*continued.*

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CATTLE—*continued.*

Shorthorns.

SANDERS, J. W., GILMORTON, LUTTERWORTH.—Dairy Shorthorns combining milk with flesh. Winners at London Dairy Show, 1908, and Shorthorns Society's Prizes, Royal Dublin, 1909 and 1910; Oxford, Royal Counties, and Royal 1910; Oxford, Leicester, Northampton, and Warwick, 1912 to 1916. Average milk yield of herd for last year, 6,835 lb. Young Bulls for sale.

SHORTHORN CALVES for rearing from best Carmarthenshire Dairy Herds always for sale. James, Cilwnwg Farm, Llanelly.

THORNTON, FRANK H., KINGSTHORPE HALL, NORTHAMPTON. Pedigree Dairy Shorthorns. Winner of many prizes, including First Prize Milking Trials, Royal Show, 1911, and First Prize Heifer Milking Class, Dairy Show, 1915. Daily milk records kept. Richness of milk a speciality.

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WELBECK HERD OF PEDIGREE SHORTHORNS, the property of the Duke of Portland. Young Bulls and Heifers for sale from the best strains. Apply, Alex. Galbraith, Norton, Cuckney, Mansfield.

WINKHURST HERD, the property of A. H. L. Bohrmann, Esq., Winkhurst Green, Ide Hill, Sevenoaks, Kent. Pedigree Shorthorns, dual-purpose type, long pedigrees only. Nearest Station: Penshurst 2½ miles.

Lincoln Red Shorthorns.

STAPLEFORD PARK HERD OF LINCOLN RED SHORTHORNS. Always a few young Red Bulls on sale at reasonable prices from certified milkers on both sides. C. S. Harvey, Wymondham, Oakham.

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PALMER, CAPTAIN, R.E.—Pure Pedigree Kerries, Bulls and Heifers, all ages. Address: The Foreman, Oaklands Park, Newdigate, Surrey. Stations: Holmwood, Horley, or Faygate, L.B. and S.C. Telegrams: Palmer, Newdigate. 20 Registered Bulls for sale.

Ayrshires.

AYRSHIRE CATTLE. Reputed largest pedigree herd in England. Inquiries invited for Bull and Heifer Calves all closely related to winners in inspection classes at Royal, Highland, Ayr, Kilmarnock, and milk yield classes: Royal. Wm. Gibson, Carrick House, Ellesmere Park, Eccles, Lancs.

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ANTONY SOUTH DEVON HERD, the property of Lieut.-General Sir Reginald Pole-Carew, K.C.B. Pedigree herd of deep-milking cattle, including cows of over 1,000 gallons. Daily milk records kept. Bulls, Cows, and Heifers for inspection and sale. Apply, W. H. Hill, Antony Estate Office, Torpoint, S.O., Cornwall.

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REDDOWN HERD BRITISH FRIESIANS. Bull Calves on sale. Stock Bulls (imported) bred Wychnor Yme Reddown Murk 17 by Reddown Imp Murk, whose dam gave an average of 51½ lb. daily for 229 days. A. F. Chillingworth, Reddown Farm, Highworth, Wilts.

SKINNER, JESSE, WRESSLE, BRIGG, LINCS. Breeder of Pedigree British Friesian Cattle. Stud Bull in use in this herd: Rockwood Frederick (6919) by Osmaston (imported) Frits (4293), sire of a calf sold for 2,500 gns. at twelve days old. Milk records. Calves always for sale.

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BIBBY, FRANK, HARDWICKE GRANGE, SHREWSBURY. Prize-winning Herefords, male and female, always for sale and export. Also Scotch Shorthorns, finest strains. Apply, Bailiff, Hardwicke Grange, Home Farm, Hadnall, Shrewsbury.

GRIFFITHS, WILLIAM, ALDERSEND, HEREFORD. Pedigree Hereford Herd. Breeder of Ringer (holder of world's record, 9,000 gns.), also One Royal, Royal Ringer, and many other world-famous sires.

BREEDERS' DIRECTORY.

CATTLE—*continued.*

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Red Polls.

ASTLEY, MAJOR D., LITTLE PLUMSTEAD HALL, NORWICH. Daily record of each cow kept. Young Bulls and Heifers always on sale. Winners of many prizes at Norfolk, Suffolk, and Royal Shows. Inspection invited.

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EASTWELL PARK HERD OF LONGHORNED CATTLE, winners of Challenge Cup, Royal Show, Bulls, 1913, 1914, and 1916; 1st and 2nd Cows 1914; 2nd 1916. Stock generally for sale. Inspection invited. Apply Henry Parsons, Estate Office, Eastwell Park, Ashford, Kent.

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BREEDERS' DIRECTORY.

SHEEP—*continued.*

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RYELAND SHEEP, the coming breed; Clytha Park Flock, winners of many prizes in previous years, including four First prizes Herefordshire and Worcestershire Show, 1916, and two First prizes, four Second prizes, and one for wool at Royal Show, Manchester, 1916; winners of First prize best pen five Ewes at Hereford Ryeland Show and Sale, August 1918. Shearling Rams and Ram Lambs, &c., for sale Apply, Manager, Clytha Park, Abergavenny.

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HOLLESLEY BAY LABOUR COLONY FLOCK. The most prolific flock of Suffolk Sheep, consisting of 350 Ewes. Ewe and Ram Lambs for sale next season. Ewe Lambs commanded highest prices past ten years. Apply to H. Barton, Superintendent.

SHEEP—*continued.*

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Various.

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PIGS.

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RIDGE HERD OF LARGE BLACK PIGS. Foundation stock from Sudbourne, Drayton, and Docking, Champion, and prize-winning strains. They are bred and reared in the open, on heavy clay soil, running out summer and winter. Boars, Gilts, and in-pig Gilts always for sale. G. R. Bennett, Ridge Farm, Capel, Surrey. Station: Ockley, two miles. Telephone: 2 Capel

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PIGS—*continued.*

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HUGHES, ALFRED, PACKWOOD GRANGE, DORRIDGE, NEAR BIRMINGHAM. Select herd of Pedigree Large White Yorkshires, bred from prize-winners. Pigs of various ages for sale at moderate prices.

STETCHWORTH HERD OF LARGE WHITE PIGS, the property of the Earl of Ellesmere. Boars and Gilts of all ages at farmers' prices. Apply, W. F. Gardner, Bridgewater Offices, Walkden, Manchester, or personally to Manager of Piggery, at Worsley, near Manchester.

PIGS—*continued.*

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BREEDERS' DIRECTORY.

PIGS—*continued.*

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